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SECOND SERIES: PULMONATA.

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MANUAL  
OF  
CONCHOLOGY

STRUCTURAL AND SYSTEMATIC.

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WITH ILLUSTRATIONS OF THE SPECIES.

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FOUNDED BY

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Vol. XIV.

ORIENTAL BULMOID HELICIDÆ; ODONTOSTOMINÆ; CERIONIDÆ.

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NOTE.—A synopsis of the soft anatomy of the *Bulimulidæ*, and an index to the species contained in volumes X, XI, XII, XIII and XIV, will be issued with the next number of the MANUAL, as a supplement to the present volume.

# MANUAL OF CONCHOLOGY.

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Vol. XIV.—*Oriental Bulimi, American Bulimulidæ, etc.*

## Part I.—ORIENTAL BULIMOID HELICIDÆ AND ZONITIDÆ.

It seems convenient to group in this place certain Eastern genera, which like *Amphidromus* were formerly referred to the *Bulimulidæ* or *Bulimidæ*, but are now known to be elongated Helices.

The genera in question are as follows :

HELICIDÆ of the group *Epiphallogona*.

*Amphidromus*, with subgenera *Beddomea* and *Pseudopartula*.  
*Draparnaudia*.

Group *Belogona euadenia*.

*Eulota*, subgenus *Dolicheulota*.

ZONITIDÆ.

*Culycia*.

*Incertæ sedis*.

*Bocourtia*.

## Genus AMPHIIDROMUS (Continued).

Subgenus BEDDOMEA Nevill, 1878.

*Beddomea* NEV., Hand List of Mollusca in the Indian Museum, pt. 1, p. 127, type *A. ceylanicus* Pfr.—PILSBRY, Proc. Malac. Soc. Lond. iv, p. 158, pl. 16 (anatomy).—*Amphidromus* and *Phengus*, Jousseume, Mém. Soc. Zool. de France pour 1894, vii, p. 295, 296.—*Bulimus* of many authors.

Shell umbilicate or perforate, oblong-conic, often carinated at the periphery, white or with brown bands or streaks; aperture usually quite oblique; peristome reflexed.

Genitalia (pl. 2, fig. 22) of typically epiphallogonous type, the

flagellum longer than and the epiphallus about as long as the penis. Duct of the oblong or ovate spermatheca lengthened, more than double the length of the penis. Penis with a large apical papilla (fig. 22).

Lung (pl. 2, fig. 23) having the pulmonary vein without large branches, the venation densest on the intestinal side and near the pneumostome, weak or well developed on the cardiac side. Kidney long and narrow, nearly or quite four times the length of the pericardium. Ureter reflexed, the secondary ureter a closed tube.

Muscles: Retractor of the penis inserted on the diaphragm as usual. The pharyngeal retractor is united to the right ocular and pedal band far forward; the left ocular muscle passes to the right of the genitalia, not between the male and female branches (pl. 2, fig. 21).

Jaw well arched, thin, with its lower margin crenulated by 10-14 flat ribs which seem separated by narrow intervals in the median part, but are contiguous or overlapping towards the ends. It is similar to that of some species of *Papuina*, intermediate between the plaited and the ribbed types.

Radula of the usual form in *Helicidæ*, the transverse rows of teeth bent at a wide angle in the middle. Rhachidian and admedian teeth with single, long, broadly rounded cusps. These pass by a gradual transition to the lateral type, in which the tooth is inclined and bears a three-lobed cusp.

Distribution, southern India and Ceylon.

Named for Col. C. E. Beddome.

The shell does not have the brilliant coloring of many *Amphidromus*, and is minutely punctulate, at least on the spire. The area of distribution is separated from that of true *Amphidromus*. I have elsewhere shown that *Beddomea* agrees with *Amphidromus* in the long, band-like kidney, the pattern of lung-venation, the arrangement of the muscles (except the eye retractor), the reproductive system and the jaw. It differs from *Amphidromus* in having the eye retractor muscle to the right of, instead of between the branches of the genitalia, in having the cusps of the teeth of the median field of the radula broadly rounded and simple, instead of deeply cloven into three cusps, as all the side-teeth are in the restricted group *Amphidromus*; and finally in having the radula longer than in *Amphidromus*.



“In view of the general agreement, it scarcely seems well-advised to accord *Beddomea* higher rank than that of a subgenus of *Amphidromus*. None of the three structural differences mentioned is of much importance, though I do not doubt that they will prove constant in *Beddomea*. When some of the species of *Amphidromus*, which are conchologically nearest *Beddomea* (such as *A. sylheticus*) come to be examined, transitions may not unlikely be found in the dentition. In the long flagellum, *Beddomea* is more like the larger, amphidrome species of *Amphidromus* than the smaller, invariably sinistral species, which so far as known, have this organ much shorter.” (*H. A. P.*, Proc. Malac. Soc. Lond. vi, p. 160.)

*Key to Species of Beddomea.*

- I. Solid and opaque, variegated with brown bands or stripes.

*trifasciatus*, p. 3.

- II. Rather thin, very pale or white, without dark markings.

*a.* Periphery rounded or but slightly angular; Ceylon: *ceylanicus*, p. 5; S. India: *physalis*, p. 8.

*a*<sup>1</sup> Periphery strongly carinate; dextral, Ceylon.

*albizonatus*, p. 7.

*a*<sup>2</sup> Periphery strongly carinate; sinistral; Travancore.

*calcadensis*, p. 9.

A. TRIFASCIATUS (Gmelin). Pl. 1, figs. 1–6, 8.

Shell dextral, compressed-umbilicate, thin but moderately strong, whitish with three brown spiral bands, the upper one often interrupted, faint or wanting, or with two wide bands separated by a light zone at the periphery; the spire white or streaked. Surface somewhat glossy, slightly striate, and under a lens showing a minute punctulation on the spire, wanting on the last and usually on the next to the last whorls. Spire conic, the apex very obtuse; whorls about  $5\frac{1}{2}$ , slightly convex, the last rounded at the periphery and beneath. Aperture oblique, ovate, white with dark markings within; lip reflexed, white, the columellar margin triangularly dilated.

Alt. 27, diam. 16, longest axis of aperture 13.5 mm.

Alt. 28, diam. 14.5, longest axis of aperture 13 mm.

*Ceylon.*

*Helix trifasciata tranquebarica* CHEMNITZ, Conchyl. Cab. ix, pt. 2, p. 155, pl. 134, f. 1215.—*Helix trifasciata* GMEL., Syst. Nat. (13),

p. 3642.—DILLWYN, Descr. Catal. ii, p. 933.—*Bulimus trifasciatus* BRUG. Encycl. Méth., p. 317.—DESH. in Lam., An. s. Vert. viii, p. 261.—PFR., Monogr. ii, 58; iii, 323; iv, 382; vi, 28; viii, 43; Conchyl. Cab., p. 50, pl. 41. f. 16, 17.—REEVE, Conch. Icon., pl. 39, fig. 237.—HANLEY & THEOBALD, Conch. Indica, pl. 21, f. 3.—LAYARD, Ann. and Mag. N. H. (2), xi, p. 226 (1853).—*Amphidromus trifasciatus* JOUSS., Mém. Soc. Zool. France, vii, 1894, p. 295.—*Buliminus (Cerastus) trifasciatus* Brug., Nevill, Hand List Moll. Ind. Mus. i, p. 132.—*Buliminus (Beddomea) trifasciatus* Chemnitz, KOBELT, Conchyl. Cab., p. 677, pl. 102, f. 22.—*Amphidromus (Beddomea) ceylanicus* (Pfr.), PILSBRY, Proc. Malac. Soc. Lond. iv, p. 159 (anatomy), pl. 16, f. 3 (jaw), of specimen figured on pl. 1, fig. 8.—*Helix (Cochlogena) trizonalis* FÉR., Prodr., no. 417.—*Bulimus zonatus* SWAINSON, Zool. Illustr. i, pl. 17 (1820).—*Bulimus fusco-ventris* BENSON, Ann. and Mag. N. H. (2), xviii, p. 96.—PFR., Monogr. iv, 404; vi, 51. (= young *trifasciatus* according to Hanl. & Theob., Conch. Ind., p. 11, from examination of the type).—*B. ceylanicus* HANLEY & THEOBALD, Conch. Indica, p. 11, pl. 21, f. 2; p. 59, pl. 148, f. 9.

*Bulimus rufopictus* BENS., Ann. and Mag. N. H. (2) xviii, p. 96. PFR., Monogr. iv, 404.—HANL. & THEOB. Conch. Ind., p. 11, pl. 21, f. 10.—*Buliminus (Beddomea) rufopictus* Bens., KOBELT, Conchyl. Cab., p. 670, pl. 102, f. 11.—*Amphidromus rufopictus* JOUSSEAUME, Mém. Soc. Zool. France vii, 1894, p. 295.

*A. trifasciatus* varies notably both in form and coloring, the wide specimens, like fig. 1, being typical. Narrow shells with the aperture smaller and a light peripheral girdle between two wide brown bands are more abundant. It varies to forms like fig. 3 of the Conchologia Indica, and others (pl. 1, fig. 2) before me from Matella, etc., having the spire more or less maculate, and sometimes with a subsutural brown line, leading to var. *rufopictus*. In another series, by loss of spiral bands a streaked form (fig. 8) is produced, such as that taken by Mr. Collett at Columbo, or a nearly uniform color. At Tamanka Layard collected specimens varying from cream-white, with only the faintest traces of streaks, to white with two heavy chestnut bands below and a faint line below the suture (pl. 1, fig. 5). A somewhat similar shell, but with the peristome purplish, is figured by Hanley and Theobald as a variety of *ceylanicus*, locality not given. Specimens collected by Mr. O. Collett at Uda Pussellawa (pl. 1, fig. 6),

have two purple-brown bands, one above, the other below the periphery, and a white lip. The lower of these two bands is homologous with the upper one of the Tamanka shells. These several forms seem to be closely connected with one another, and not separable as species.

*A. trifasciatus* "I should term a low country species. I have taken it about Galle and Matura." "Essentially a tree species." (*Layard*.)

Var. *rufopictus* (Benson). Pl. 1, fig. 9. Shell smaller, alt. 19–23 mm., usually two- or three-banded below, *spotted or dotted with corneous-brown* on a pale brown ground, the first two whorls uniform. Surface of spire densely punctate.

Ceylon: *Kandy*, 1,500 ft. elev. (O. Collett); *Akurambode* (*Layard*.)

Distinguished chiefly by its copious maculation. A specimen from Kandy before me is more conic than that figured from Akurambode, with the bands nearly obsolete.

#### A. CEYLANICUS (Pfeiffer). Pl. 1, fig. 7.

Shell openly perforate, ovate-conic, solid, obliquely striatulate, somewhat shining, white or fleshy-brown; spire conic, rather acute; whorls 6, flattened, the last about three-sevenths the length of the shell; columella slightly arcuate. Aperture truncate-oval; peristome widely expanded, a little reflexed, the columellar margin dilated, reflexed, spreading. Length 27, diam. 14, aperture inside 11 mill. long (*Pfr.*). *Ceylon* (Templeton, in Cuming coll.).

*Bulimus ceylanicus* PFR., *Symbolæ Hel.* iii, p. 83 (1846); *Monogr.* ii, p. 59.—REEVE, *Conch. Icon.*, pl. 43, f. 274.—DESL., in *Fér.*, *Histoire*, p. 70, pl. 145, f. 5, 6.—LAYARD, *Ann. Mag. N. H.* (2), xi, p. 226 (1853).—*Buliminus (Beddomea) ceylanicus* Pfr., *KOBELT*, *Conch. Cab.*, p. 680, not the figures.

This species differs from *A. albizonatus* and its varieties in the rounded last whorl, a keel being absent. Pfeiffer's dimensions agree with a specimen before me if his method of measuring the diameter be followed. Including the outer lip, the shell would be wider, length  $26\frac{1}{2}$ , diam.  $15\frac{1}{2}$  mill. In my opinion the shells figured for *ceylanicus* in the *Conchologia Indica* are forms of *A. trifasciatus*, and not Pfeiffer's species. Kobelt has copied these figures in the *Conchylien Cabinet*, pl. 103, f. 5, 6.

Mr. E. R. Sykes (*in litt.*) writes that he believes *ceylanicus* and

*albizonatus* will prove to be extreme varieties of a single species. The former name is the earlier. The specimen dissected by me, reported as *ceylanicus* (Proc. Mal. Soc. Lond.), is a streaked but bandless form of *trifasciatus*.

"The animal is of a beautiful green color, and when alive shines through the shell. I am told they feed much on coffee bushes. Essentially a tree species" (*Layard*).

Var. INTERMEDIUS (Pfeiffer). Pl. 1, figs. 10, 11, 12.

Shell perforate, elongate-conic, rather solid, obliquely striatulate punctulate, glossy, white; spire conic, rather obtuse; suture lightly impressed, simple, whorls 6, rather flattened, the last about three-sevenths the length of shell, subangular below the middle, the base swollen; columella slightly folded, somewhat receding. Aperture oblique, truncate-oval; peristome rather broadly expanded, a little reflexed, margins joined by a thin callus, the columellar margin dilated, triangular and flat. Length 34, diam. 16 mill.; aperture with peristome 17 mill. long, 8 wide inside (*Pfr.*).

Ceylon (Thwaites, type in Cuming coll.); *Watawala* (O. Collett).

*Bulimus intermedius* PFR., P. Z. S., 1854, p. 291; Novit. Conch., i, p. 30, pl. 8, f. 10, 11; Monogr., iv, 386.—HANL. & THEOB., Conch. Indica, pl. 19, f. 6, 8 (perhaps are *ceylanicus*).—*Phengus intermedius* JOUSSEAUME, l. c., p. 295.—*Helix* (*Geotrochus*) *mesogena* MARTENS, Die Hel., p. 168 (1860); a substitute for Pfeiffer's name.—*Amphidromus* (*Beddomea*) *intermedius* PFR., PILSBRY, Proc. Malac. Soc. Lond., iv, p. 158, pl. 16, f. 2, 2a, 4, 6, 7 (anatomy).—*Bulimimus* (*Beddomea*) *intermedius* PFR., KOBELT, Conchyl. Cab., p. 679, pl. 103, f. 2, 3.

The extremely thin cuticle is deciduous; when present it is faintly yellow tinted beneath. The angle at the periphery is so slight as to be scarcely noticeable; in many specimens it hardly modifies the oval contour of the last whorl, and sometimes can scarcely be seen. The specimens before me are punctulate only on the spire, the last whorl being smooth. They vary in size from 29 to 34 mm. Figs. 10, 11 are copies of the type figures; fig. 12 is from a *Watawala* specimen. Differs from *ceylanicus* in being larger and faintly keeled, but probably all intergrades occur. The weakness of the peripheral carina is all that separates *intermedius* from *albizonatus*, but this character varies widely in both forms.

**A. ALBIZONATUS** (Reeve). Pl. 1, fig. 14, 15, 16.

Shell somewhat pyramidally conical, rather depressed at the base, scarcely umbilicated; whorls seven in number, flatly convex, obliquely finely striated; sutures peculiarly linearly engraved; last whorl angled at the base; columella broadly reflected; bluish-white within and without, having a narrow opaque white zone at the angle of the last whorl (*Reeve*). Length 34, diam.  $21\frac{1}{2}$  mill. (from fig.).

*Ceylon* (Taylor coll.).

*Balimus albizonatus* REEVE, Conch. Icon. pl. 81, f. 604 (Dec., 1849).

“A pale, blue-white shell, remarkably characterized by a narrow opaque-white zone round the middle of the whorls, exactly in the place of the suture, concealed in all but the last whorl by the superposition of one whorl upon the other.” (*Reeve*.)

Mr. E. R. Sykes, who kindly examined the type now in the British Museum for me, states that a trace of minute pitting is visible.

Numerous specimens before me (pl. 1, figs. 14, 15) are smaller than *Reeve's* type, measuring from length 29, diam. 18, to length 23, diam. 14 mill. The thin cuticle is more or less yellow tinted beneath, and the periphery either marked by a white line or not. *The angle is frequently almost completely obsolete on the face of the whorl, even when strong on the back.* The spire is punctulate or densely subgranulose, at least above, but not on the last whorl. They come from Matella and “western province” of Ceylon, collected by Layard. Fig. 14 shows the peripheral keel by far too strong; it is almost imperceptible in the middle of the front of the shell.

Kobelt (Conch. Cab. p. 680) states that he gives the figure from the Conch. Icon. on his plate 103, f. 4, but he evidently did not do so. His figure is a smaller variety probably referable to *simoni*.

Var. *SIMONI* (Jousseaume). Pl. 1, figs. 17, 18.

Shell dextral, compressed-umbilicate, thin but moderately solid. White under a thin pale buff, somewhat caducious cuticle; glossy, faintly striate, very densely microscopically punctulate throughout. Spire straightly conic, the apex obtuse. Whorls  $5\frac{1}{2}$  to 6, the first two convex, the rest but slightly so; last whorl acutely carinated at the periphery. Aperture very oblique, ovate; peristome white, expanded and reflexed, the columellar margin dilated above.

Alt. 25-26, diam. 18-19 mm. (Jousseaume).

Alt. 24, diam.  $17\frac{1}{2}$ , longest axis of aperture 14 mm.

Ceylon: *Galle* (M. Simon); *Udagama* (Collett).

*Bulimus albizonatus* PFR., Monogr. iii, 330 (exclusive of reference to Reeve); Conchyl. Cab., p. 155, pl. 49, f. 1, 2.—HANL. & THEOB., Conch. Ind., pl. 21, f. 8.—*Phengus simoni* JOUSS., Mém. Soc. Zool. de France, vii, 1894, p. 296, pl. 4, f. 7.—*Amphidromus* (*Beddomea*) *albizonatus* Rve., PILSBRY. Proc. Malac. Soc. Lond. iv, p. 159, pl. 16, f. 1, 5 (anatomy).

Differs from typical *albizonatus* by the smaller size, by having one whorl less, a stronger keel, and it wants the white keel-band of *albizonatus*. The surface is densely punctulate or granulose, below as well as above. This is the most strongly carinated of the chain of white Ceylonese Amphidromes, which has its opposite extreme in the rounded *A. ceylanicus*. Named for M. E. Simon, the araneologist, who collected the types in 1892, while exploring Ceylon for spiders. Fig. 17 is a copy of the type figure, representing a specimen from Galle. Fig. 18 was drawn from a shell collected at Udagama by Mr. Collett. It was one of these that I dissected.

A. PHYSALIS (Benson). Pl. 1, fig. 13.

Shell nearly covered perforate, ovate-conic, rather thin, obliquely striatulate, whitish, glossy; spire conic, the apex obtuse, suture lightly impressed. Whorls  $5\frac{1}{2}$ , somewhat flattened above, the first granulated, the rest decussated with minute spiral striæ, last whorl a little swollen, four-ninths the length of the shell, usually angulate at the periphery. Aperture ample, oblique, truncate-pyriform; peristome expanded, the margins reflexed, joined by a thin callus; columellar margin very broad above, appressed, obliquely lightly impressed, nearly covering the narrow, pervious umbilicus. Length 27-28, diam. 16-17, aperture 14-16 mill. (*Bens.*)

*Khoonda Ghât, Nilgiri Hills* (T. Jerdon), *Wynaad* (Stoliczka), *Southern India*.

*Bulimus physalis* BENS., Ann. and Mag. N. H. (2), xix, p. 328 (April, 1857).—PFR., Monogr. iv, 386.—HANL. & THEOB., Conch. Ind., pl. 21, f. 9.—*Amphidromus* (*Beddomea*) *physalis* NEVILL, Hand List Ind. Mus. i, p. 127.—*Buliminus* (*Beddomea*) *physalis* BENS., KOBELT, Conchyl. Cab. i, 678, pl. 103, f. 1.

“Well distinguished from the Cingalese species, *albizonatus* Reeve,

*ceylanicus* and *intermedius* Pfr., by its more ventricose form, the more ample aperture and the mode of sculpture. A perfect specimen in the Museum of the India House, and a young one received from Dr. Jerdon, have the periphery angulate; whereas an adult specimen communicated by Dr. Jerdon is deficient in this feature" (*Bens.*).

A. CALCADENSIS ('Beddome' Blanford). Pl. 1, figs. 19, 20.

Shell sinistral, nearly covered perforate, high trochiform, rather solid, striatulate, whitish, covered with tawny cuticle (or yellowish, perhaps variegated). Spire conic, the apex obtuse, suture impressed. Whorls  $5\frac{1}{2}$ , convex, regularly increasing, the last about three-sevenths the total length, carinated, convex beneath, more swollen in front. Aperture oblique, somewhat rhombic; peristome not thickened, a little expanded, the margins distant, connected by a thin callus, columellar margin triangularly reflexed, nearly closing the perforation. Length 23, diam. 17, aperture with peristome 11 mill. long, 8 wide inside. (*Blanf.*)

*Calcad Hills, Travancore* (Beddome, Bourdillon.)

*Bulimus calcadensis* Beddome MS., W. T. BLANFORD, Journ. Asiat. Soc. Bengal, xxxix, pt. 2, p. 18 (1870).—PFR., Monogr. viii, p. 65.—HANLEY & THEOBALD, Conch. Indica, p. 59, pl. 148, f. 2, 3.—*Geotrochus calcadensis* Bedd., THEOBALD, J. A. S. B. xlv, pt. 2, p. 187, pl. 14, f. 7 (1876).—*Buliminus* (*Beddomea*) *calcadensis* W. Blf., KOBELT, Conch. Cab., p. 681, pl. 103, f. 7, 8.

A single specimen, much weathered but perfect, was found by Major Beddome. It is evidently a colored shell, but only traces of the epidermis remained. It is allied to *B. albizonatus* Rv. and *B. intermedius* Pfr., of Ceylon, but is sinistral and has a shorter, more conical form." (*Blanf.*). A specimen collected by Mr. Bourdillon (fig. 20) is "slightly smaller than the type, measuring, alt. 20, greater diam, 14.8, lesser 12.8, aperture, alt. 11, width 8 mill." (*Theob.*)

Subgenus PSEUDOPARTULA Pfr., 1855.

*Pseudopartula* PFR., Mal. Blätt. ii, p. 162 (for *B. galeficulum*).—*Pseudopartula* PFR., Monogr. iv, p. 365.—PILSBRY, Nautilus x, 1897, p. 109.—ANCEY, Ann. Mus. d' Hist. Nat. Marseille, Bull. i, 1898, p. 147.—*Geotrochus* MARTENS; *Helix* METCALFE; *Nanina* PFR. et al.; *Dyakia* KOBELT.

Shell sinistral, trochiform or depressed, of  $5\frac{1}{2}$  or 6 whorls, thin,

milky-subtranslucent, the surface with fine spiral and growth striæ, apex smooth and obtuse; aperture extremely oblique, with well reflexed peristome. Mantle green; the soft anatomy otherwise unknown. Type *Bulimus galericulum* Mouss.

Distribution: Java, Sumatra and Borneo. Arboreal.

A small group of tree snails, by their form recalling *Papuina* or *Draparnandia*, but in texture similar to *Beddomea*. As in the latter group, the mantle shows green through the shell, evidently a protective coloration. The species composing the group were first associated by the writer in 1897. Prof. von Martens, as early as 1860, grouped the Javan *B. galericulum* with the Ceylonese forms now referred to *Beddomea*. There is evidently a close relationship between *Pseudopartula* and *Beddomea*; the former being distinguished mainly by its non-punctate surface, more oblique aperture, and geographic distribution.

The name of the group, 'false Partula,' was probably suggested by Mousson's comparison of *A. galericulum* with that genus.

The sinistral coil of the whorls, though mentioned in the diagnosis of the subgenus, is probably of minor significance. *Calycia everetti* of Celebes seems to me to belong to this group rather than to *Calycia*.

#### *Key to Species of Pseudopartula.*

1. Shell acutely carinate, the outer angle of the aperture projecting in a "spout."
  - a. Heliciform, the diameter exceeding the alt. Borneo.  
*A. nasutus.*
  - b. Trochoidal, the diameter less than the alt. Sumatra.  
*A. doherityi.*
2. Shell Bulimoid, the aperture rounded outwardly. Java.  
*A. galericulum.*

*A. GALERICULUM* (Mousson). Pl. 2, figs. 31, 32, 33.

Shell sinistral, imperforate, ovate-conic, subangulose, thin, subdiaphanous, slightly glossy, delicately striated transversely and spirally. Spire conic, the suture linear, summit ornamented with a black dot, whorls 6, rather flat, the last two-fifths the length, inflated at the columella; the keel becoming obsolete upon it. Aperture very oblique, obliquely ovate at a tangent to the base; columella short, obliquely incurved; peristome widely and flatly expanded, milk-white,



conspicuously bordered inside by a blackish-brown band. Length 17, diam. 12 mill. (*Mouss.*).

Java: *Pardana district* (Zollinger).

*Bulinus gallericum* MOUSS., Moll. Java, p. 34, pl. 3, f. 5 (1849).—PFR., Monogr. iii, p. 302.—*Bulinus* (*Pseudopartula*) *gallericum* PFR., Mal. Blätt. ii, 1855, p. 162.—*Helix* (*Geotrochus*) *gallericum* MARTENS, in Alb., Die Hel., p. 168, 169; Ostas. Landschn., p. 324. *Amphidromus* (*Beddomea*) *gallericum* BOETTGER, Bericht. Senckenb. Naturforsch. Ges., 1890, p. 146.—*Pseudopartula gallericum*, with var. *gedeana* PILSBRY, Nautilus x, p. 110 (Feb., 1897).—*P. gallericum*, with var. *fasciata* and *impunctata* ANCEY, Ann. Mus. Hist. Nat. de Marseille, ser. 2, Bull. i, p. 147 (1898).

The species was based upon a single specimen, described as imperforate, and having a dark apex and border within the lip. The varieties *impunctatus* and *fasciatus* agree with Mousson's figures in form, but var. *gedeanus* is more slender with a very convex base and no peripheral angle.

Color-var. *impunctatus* Ancey. Pl. 2, fig. 30. A little smaller, with  $5\frac{1}{2}$  whorls, the last somewhat more carinated; perforate; without dark markings at apex and interior of the lip. Alt. 15, diam.  $10\frac{1}{2}$  mill.

Color-var. *fasciatus* Ancey. "Having a narrow dark band at the middle of the last whorl. Western Java."

Var. *gedeanus* ('Bttg.' Pils.). Pl. 2, fig. 29. Perforate; more elongated than the type, the peripheral angle wanting, base hanging sack-like; bluish-white, the lip and a sutural line opaque white; no dark markings. Alt. 19, diam.  $11\frac{1}{2}$  mill.

The base of the shell has a shape quite different from that of the type, or the color-variety *impunctatus*. The form mentioned by Boettger as collected by Dr. Ad. Strubell at Gunung Salak probably was this variety. It measured, alt.  $18\frac{1}{2}$ , diam.  $11\frac{1}{2}$  mill.

A DOHERTYI (Aldrich). Pl. 2, figs. 34, 35.

Shell sinistral, perforate, thin, pyramidal-trochiform, bluish-white, somewhat glossy, with irregular growth-striae and fine, weak spiral impressed lines. Spire pyramidal, the apex obtuse; whorls 6, several earlier convex, the rest nearly flat, separated by narrowly white-edged sutures, the last whorl acutely keeled at the periphery, nearly flat below. Aperture extremely oblique, pyriform, the outer angle

produced in a shallow, slightly recurved spout situated mainly below the termination of the carina; upper and basal margins reflexed. Alt. 20, diam. 15 mm.

Sumatra: *Marang*, on the southwestern coast (W. Doherty).

*Nanina (Ariophanta) dohertyi* ALDRICH, *Nautilus* vi, p. 90 (December, 1892), pl. ii, f. 1, 2.—*Pseudopartula dohertyi* PILS., *Nautilus* x, p. 110 (Feb., 1897).

Arboreal, and when alive of a green color, from the hue of the mantle showing through the translucent shell. It is much more elevated than the allied *A. nasutus*.

*A. NASUTUS* (Metcalf). Vol. II, pl. 3, fig. 42.

Shell subdiscoidal, sinistral, carinate, narrowly perforate, very thin, decussated by very fine spiral and growth lines; pellucid, hyaline, ornamented with a narrow pale brown line at the carina; spire somewhat conic, whorls  $5\frac{1}{2}$ , flattened, the last one very acutely carinate, glossy beneath. Aperture subrhomboidal, much produced at the outer angle; peristome simple, thin, the upper margin scarcely reflexed, basal margin more reflexed in front, nearly covering the umbilicus. Length 1.4, width 1.1, alt. 0.5 inch (*Metcalf*).

Borneo (Rajah Brooke, Wallace); *Baram* (Kükenthal).

*Helic nasuta* METC., P. Z. S., 1851, p. 70.—REEVE, *Conch. Icon.*, f. 1031.—PFR., *Monogr.* iii, p. 203.—*Nanina (Ariophanta) nasuta* PFR. & CLESS., *Nomenclator Hel. Viv.*, p. 56.—TRYON, *Man. Conch.* (2), ii, p. 21, pl. 3, f. 42.—*Ryssota? nasuta* WALLACE & H. ADAMS, P. Z. S., 1865, p. 407.—*Nanina nasutus* MARTENS, *Ostas. Zool., Landschn.*, p. 224.—*Dyakia nasuta* KOBELT, *Abhandl. Senck. Ges.* xxiv, p. 53.

“Covered with a thin epidermis of a pale straw color, under which the shell is milky white.”

Kobelt describes a specimen from Baram, collected by Kükenthal, decidedly smaller than the type, measuring, alt. 12, diam. 31 mill. The color is very pale corneous-green.

Genus DRAPARNAUDIA Montrouzier, 1859.

*Draparnandia* MONTR., *Journ. de Conchyl.* vii, p. 288 (1859), for *D. michaudi* Montr., = *B. sinistrorsus* Desh.—PILSBRY, *Nautilus* x, p. 110 (Feb., 1897).—ANCEY, *Nautilus* xi, p. 27; *Ann. Mus.*

d'Hist. Nat. Marseille, Bull. i, p. 147 (1898).—*Pseudopartula* sp., CROSSE, Journ. de Conchyl. 1894, p. 246.

Shell small, sinistral, perforate, turbinate-conic, covered with a yellow or brown cuticle. Whorls  $5\frac{1}{2}$ –7, convex, very obliquely striated. Aperture very oblique, truncate-oval, the peristome expanded or simple, columellar margin broadly dilated and built forward, columella simply concave. Type *D. sinistrorsa* (Db.).

Jaw (pl. 3, fig. 15) arcuate with a slight median projection below, and apparently smooth or vertically striate. Radula with the central tooth unicuspid, the cusp shorter than the basal plate; laterals with similar mesocone and an ectocone developed; marginal teeth oblique, quadricuspid by deep splitting of the meso- and ecto-cones (pl. 3, fig. 14).

Genitalia (pl. 3, fig. 12) of epiphallagonous type, a stout epiphallus as long as the penis being inserted near the distal end of the latter. Vas deferens terminal on the epiphallus, the flagellum apparently wanting. Spermatheca ovate, on a moderately long duct, which is swollen below. Sometimes the duct is stouter, as in detail figure to the left. The vagina is short.

Distribution, New Caledonian and New Hebrides groups. Living on the ground.

The genus is named in honor of the great French conchologist Jacques Draparnaud, 1772–1804. It was introduced by Montrouzier in an unsatisfactory manner, but since there is no conflicting name, that given by the noble French missionary and naturalist will stand.

The anatomy of *D. lifuana* has been investigated by Messrs. Wm. Moss and W. M. Webb (1897), from whose article the anatomical details given above are derived. It is clear that the group belongs to the sub-family *Camæninæ* (epiphallagona) of the *Helicidæ*, having the characteristic genital system of that division. The flagellum is apparently atrophied, as in *Cristigibba* and some species of *Papuina*.

*Draparnaudia* has no especially close relations with *Amphidromus* and its subgenera, but stands nearer *Papuina* perhaps than to any other genus; the different texture of the shell being correlated with terrestrial habits, while *Papuina* is arboreal. The inter-relations of the genera of epiphallagonous *Helicidæ*, however, have not yet been worked out, though valuable material has been accumulated by Wiegmann, Hedley and others, since the publication of my "Guide to the Helices."

*Key to Species of Draparnaudia.*

*a.* Last whorl acutely carinate, at least in front. *singularis*, p. 14.

*a.*<sup>1</sup> Last whorl rounded, or at most bluntly angular in front.

*b.* Whorls  $5\frac{1}{2}$ , the last depressed; aperture rounded oval; alt. 4-5 mill. *turgidula*, p. 16.

*b.*<sup>1</sup> Whorls  $6\frac{1}{2}$ -7; size larger.

*c.* Last whorl depressed, expanding toward the aperture; peristome thin, well expanded; diam. about four-fifths the alt. *sinistrorsa*, p. 15.

*c.*<sup>1</sup> Last whorl rounded or somewhat flattened peripherally, not dilated toward the aperture.

*d.* Pointed-ovate, dark brown, the diam. two-thirds the alt.; umbilicus narrow; lip narrowly expanded and thickened.

*crossei*, p. 17.

*d.*<sup>1</sup> Short and stout, the lip not expanded or thickened; diam. three-fourths the alt.

*lifuana*, p. 17.

D. SINGULARIS (Pfeiffer). Pl. 3, fig. 1.

Shell sinistral, openly umbilicate, trochiform, *yellowish-chestnut colored*. Surface rather glossy, sculptured with rather coarse, very oblique wrinkles of growth, and fine spiral lines on the base. Spire conic with noticeably concave lateral outlines. Whorls  $6\frac{3}{4}$ , the last depressed, *acutely carinated at the periphery*, the keel usually serrated a little; suture descending a little below the keel in front. Aperture extremely oblique; peristome well expanded, white, the upper margin arched, basal more or less straightened.

Alt. 10, diam. 9.4; longest axis of aperture 6.5, width 4.5 mill. (Kanala).

Alt. 8.5, diam. 7.5 mill. (Prony Bay).

New Caledonia: *Isle of Pines* (Lambert); *Prony Bay* (Brazier); *Kanala* (Dupuy). New Hebrides: *Aneiteum* (Macgillivray, Layard).

*Helix singularis* PFR., P. Z. S., 1854, p. 290; Mal. Blätt. 1855, p. 145; Monogr. iv, p. 255.—*Pseudopartula singularis* CROSSE, Journ. de Conchyl. 1894, p. 248.—*Draparnaudia singularis* ANCEY, Nautilus, July, 1897, p. 27; Ann. Mus. d' Hist. Nat. Marseille, Bull. i, p. 147 (1898), with var. *major* Anc.—*Bulinus sinistrorsus* var. *carinatus*, magis striatus, GASSIES, Faune Conch. N.-Caléd, ii, p. 92 (1871).

Allied to *D. sinistrorsa*, but differing in the acute peripheral keel, flatter base with more distinct spiral lines, and uniform darker color. It has about a half whorl less than *sinistrorsa*, and the spire is a little more slender above.

It was originally described from Aneiteum, New Hebrides, the type measuring alt. 7, greater diam. 9, lesser 7 mill. Pfeiffer measured the *axis* of the shell, not to the base of the lip; so that his type was about equal in size to the average New Caledonian specimens. Reeve's figures confirm the proportions, though being enlarged, not the size, of the typical *singularis*. A shell before me from the New Hebrides, probably from Cuming, measures alt. 9, diam. 8.3 mill. It is light brown, paler than New Caledonian shells, but perhaps faded. Mr. Ancey (*Nautilus* 1897, p. 27) mentions specimens from Aneiteum, received from E. L. Layard, "much smaller than any I ever saw from New Caledonia;" and in a later paper he gives the New Caledonian shells the name "*var. major*" (without description). It is evident, however, that the facts do not support such separation.

D. SINISTRORSA (Deshayes). Pl. 3, figs. 2, 3.

Shell sinistral, openly umbilicate, turbate-conic, *straw-yellow*. Surface somewhat glossy, sculptured with fine and very oblique growth-wrinkles. Spire conic, the lateral outlines straight (or slightly concave above); whorls 7, moderately convex, closely coiled, *the last whorl depressed, rapidly expanding near the aperture* (especially noticeable in a view from above), *rounded at the periphery* and beneath, perforated by a deeply penetrating, comma-shaped umbilicus. Aperture extremely oblique, truncate oblong; the peristome white, *well expanded*, upper margin *evenly arched*, basal-columellar margin straight, parietal callus transparent but rather heavy.

Alt. 9.4, diam. 8.3 mill.; longest axis of aperture 5.8, width 4.3 mill.

Alt. 10, diam. 8.5 mill.; longest axis of aperture 6, width 4.4 mill.

New Caledonia: *Isle of Pines* (Lambert); *Mount Mou* (Marie); also Ouvéa and Maré, Loyalty Is.

*Bulinus sinistrorsus* DESH., in Fér., *Histoire* ii, p. 24, pl. 161, f. 19-21 (1840).—GASSIES, *Faune Conch. N.-Caléd.* i, p. 51, pl. 2, f. 3 (1863).—PFR., *Monogr.* iii, p. 322.—*Helix sinistrorsa* PFR., *Monogr.* iv, 260; v. 337, 502.—*Draparnaudia michaudi* MONTROF-

ZIER MS., Journ. de Conchyl. vii, 1859, p. 288.—*Bulinus sinistrorsus* var. B, *castaneo fasciatus* MONTR., J. de C. vii, 1859, p. 287, pl. 8, f. 3.—*B. s.* var. *castaneo zonulatus*, and var. *albido zonulatus* GASSIES, Faune Conch. N.-Caléd. ii, p. 92, 188.—*Pseudopartula sinistrorsa*, with var. *castaneo-fasciatus* and *albido zonulata* CROSSE, J. de C., 1894, p. 246, 247.

Deshayes' single specimen had lost the early whorls, and in restoring them in his figures he makes the spire somewhat too high. The coloration, "albida sub epidermide lutescente," the depressed last whorl, "ultimus depressus," as well as the rapid expansion of the latter, as shown in his figure 20, and the form of the mouth, all indicate unmistakably that Montrouzier and Gassies correctly identified the shell.

*B. sinistrorsus* is said to occur fossil on the Isle of Pines and Koutoumo islet; but Gassies included *H. singularis* Pfr. as a variety of *sinistrorsus*, so the occurrence of the true *sinistrorsa* on the Isle of Pines requires confirmation.

Var. CASTANEOFASCIATA (Montrouzier). Pl. 3, fig. 4.

Decidedly larger than *sinistrorsa*, with the same form and number of whorls; gray-buff with a broad chestnut band at the periphery, often faint, and fading at its edges into the ground-color; spire reddish above; parietal callus thin. Alt. 12–14, diam. 11; long axis of aperture 8.5, width 6 mill.

Art Island (Gassies).

Var. *albidozonulata* Gassies has been defined by the name, "whitish zoned," only; and is said by Gassies to agree with the typical form in contour. It is from Maré, Loyalty Is.

Just what form occurs on Ouvéa Island is not known to me. The supposed *B. sinistrorsus* from Lifu is *D. lifuanu*.

D. TURGIDULA (Gassies). Pl. 3, figs. 5, 6.

Shell sinistral, openly umbilicate, turbinate-conic, thin, light brown. Surface somewhat glossy, coarsely wrinkle-striate. Spire conic, the outlines slightly concave; whorls  $5\frac{1}{2}$ , strongly convex, the last depressed, rounded at the periphery. Aperture rounded-oval, oblique, the peristome slightly expanded, both outer and columellar margins arcuate, the latter dilated, the ends approaching and connected by a thin callus.

Alt. 5, diam. 3.5, length of aperture 2, width 2 mill. (Gassies).

Alt. 4.3, diam. 3.5, longest axis of aperture 2, width 1.7 mill.

New Caledonian group: *Non Island* (Lambert); *Noumea* (Dupuy).

*Bulinus turgidulus* GASSIES, Faune Conch. N.-Caléd. ii, p. 188 (1871); Journ. de Conchyl. xxi, p. 49, pl. 2, f. 4 (1873).—*Helix turgidula* Gass., PFR., Monogr. vii, p. 388.—*Pseudopartula turgidula* Gass., CROSSE, Journ. de Conchyl. 1894, p. 248.—*Draparnaudia turgidula* Gass., ANCEY, l. c.

A miniature *D. sinistrorsa*, but having the umbilicus more open, the aperture more nearly round, with less expanded peristome, the whorls rather more convex and fewer by one and a half. The specimens from Noumea are a little smaller than those from Non Island.

*D. CROSSEI* Pilsbry, n. sp. Pl. 3, figs. 10, 11.

Shell sinistral, umbilicate, turbinato-pyramidal, rather solid, chestnut brown, whitish at the apex. Surface somewhat glossy, sculptured with irregular growth-wrinkles. Spire high-conic, the lateral outlines straight or a little concave near the apex. Whorls  $6\frac{3}{4}$ , somewhat convex, the last convex or a little flattened at the periphery, not angular, and but little expanded toward the aperture; base convex; umbilicus narrow. Aperture very oblique, dark brown or purple-brown within; peristome white or nearly so, *thickened within* and on the face, *very narrowly expanded*; outer lip arcuate, especially near the upper insertion; baso-columellar lip straightened and dilated above; both margins thickened at their insertions and connected by a rather strong but transparent parietal callus.

Alt. 11.5, diam. 7.6, longest axis of aperture 6, width 4.5 mill.

New Caledonia (E. Marie).

This species stands between *D. sinistrorsa* and *D. lifuana*. The former is much more openly umbilicate, the last whorl is more depressed, much more expanded towards the aperture, the peristome is not so thickened, and the color is much lighter. Compared with *D. lifuana*, the present species is more elongate, darker, and has a narrowly expanded, thickened peristome. Four specimens, essentially alike, are before me.

*D. LIFUANA* Pilsbry, n. n. Pl. 3, figs. 7, 8, 9, 12-15.

Shell sinistral, perforate and rimate, turbinato, "uniform grayish fulvous, buff-tinted toward the apex," or dirty white with yellowish spire. Surface dull, with irregular growth-wrinkles, stronger at the

sutures. Spire conic, the sides slightly concave, whorls  $6\frac{1}{2}$ , convex, the last globose-depressed, swollen above and below, a little flattened peripherally, somewhat descending in front. Aperture oblique, round-oval, chestnut-brown within; peristome white, the outer lip *not expanded*, strongly arcuate above; columellar lip less arcuate, dilated, the ends approaching, connected by a moderate callus.

Alt. 8, diam. 6; length of aperture 3.5, width 3 mill. (*Gassies*).

Alt. 8, diam. 6.2; longest axis of aperture 4.2, width 3.4 mill. (specimen). Loyalty Is.: *Lifu* (Déplanches, Hadfield).

*Bulinus theobaldianus* GASS., Journ. de Conchyl. xviii, p. 143, pl. 3, f. 9 (Jan., 1870); Faune Conch. N.-Caléd. ii, p. 93, pl. 3, f. 8 (1871).—PFR., Monogr. viii, p. 96.—*Buliminus* (*Chondrula*) *theobaldiana* PFR. & CLESS., Nomencl. Hel. Viv. 1878, p. 296, no. 668. *Pseudopartula theobaldiana* Gass., CROSSE, Journ. de Conchyl. 1894, p. 248.—*Draparnaudia theobaldiana* Gass., ANCEY, Ann. Mus. d'Hist. Nat. Marseille, Bull. i, p. 147 (1898).—*Bulinus sinistrorsus* MOSS & WEBB, Journ. of Malacol. vi, p. 1, pl. 1, f. 1 (shell), 2-6 (anatomy). *Helix* (*Geotrochus*) *sinistrorsa* Desh., MELVILL and STANDEN, Journ. of Conch., viii, p. 87, 1895. Not *Bulinus theobaldianus* Benson, 1857, see Manual, vol. xiii, p. 180.

The unexpanded lip, and short, stout contour readily distinguish this from other species. The umbilicus is more compressed than in *D. sinistrorsus* and the last whorl much less depressed, and not expanded at the aperture. The name *theobaldianus* was for the Marquis Théobald de Puifferrat, a friend of M. Gassies. There was unfortunately a prior *B. theobaldianus* of Benson, necessitating a change of the name of the present species. The type of *D. lifuana* (figs. 8, 9) is in the collection of the Academy.

#### Genus EULOTA Hartmann.

*Eulota* Hartm., PILSBRY, Man. Conch. ix, p. 200.

#### Subgenus DOLICHEULOTA Pilsbry, 1901.

Shell umbilicate, solid, *Buliminus* shaped, having the sculpture and color-pattern of *Euhadra*. Aperture ovate, longer than wide, the peristome reflexed. Type *Buliminus formosensis* H. Ad.

The soft anatomy is unknown, but I venture to predict that it will be found to agree essentially with *Euhadra*. Those who give generic rank to the numerous groups I have subordinated to *Eulota* will



naturally treat the present one as a genus. Whether such minute subdivision of all Helicid genera as some authors advocate will eventually win general acceptance is still uncertain, but in my opinion over-division of genera defeats the end of nomenclature, losing sight of the characters of real importance.

My opinion of the position of this group is based upon the sculpture and system of coloration of the shells. The species have hitherto been placed in *Bulinus* (Pfeiffer), *Amphidromus* (Kobelt, von Moellendorff *et al.*), and *Cochlostyla* (Paetel).

*D. SWINHOEI* (Pfeiffer). Pl. 2, figs. 24, 25.

Shell umbilicate, ovate-conic, rather thin, obliquely striatulate, decussated by very close spiral striae; tawny, irregularly ornamented with brown and blackish streaks. Spire convexly conic, pale above, the apex acute, whorls  $6\frac{1}{2}$ , a little convex, the last shorter than the spire, rounded beneath. Aperture a little oblique, truncate-oval, bluish-pearly within; peristome simple, thin, the right margin narrowly expanded, the columellar margin broadly reflexed, overhanging the umbilicus. Length 35, diam. 20 mill.; aperture 18 mill. long, 11 wide (*Pfr.*).

*Formosa* (Swinhoe; type in Cuming coll.).

*Bulinus swinhoei* PFR., P. Z. S. 1865, p. 830, pl. 46, f. 2, 2a; Malak. Bl. xiii, 1866, p. 42; Monogr. vi, p. 56; viii, p. 69.—*Amphidromus swinhoei* MLLDF., Jahrb. xi, 1884, p. 163.

I have seen a single dead and bleached specimen of this species, collected by Prof. Steere. It differs from *D. formosensis* chiefly in the thin, much less developed lip. The name is preoccupied in *Euhadra*; and if *Dolicheulota* really proves to have the anatomy of that group, as I believe, the present species will require a new name. I would suggest *E. swinhoeana*.

*D. FORMOSENSIS* (H. Adams). Pl. 2, figs. 26, 27, 28.

Shell umbilicate, oblong-conic, solid, covered with an olivaceous brown cuticle, which is variegated by some light flames or spots, and rather indistinct spiral bands; usually denuded toward the apex, where the whorls are brown above, whitish below. Surface somewhat shining, with irregular growth-wrinkles and fine, close, clearly-engraved spiral striae, sometimes subobsolete on the last whorl. Spire conic, with more or less convex lateral outlines. Whorls  $7-7\frac{1}{2}$ ,

slightly convex, the last convex at periphery and beneath, scarcely descending in front. Aperture but slightly oblique, ovate, bluish-white within; peristome lead-colored with brown edge, broadly reflexed below, narrowly above; the columella vertical and straight above, its margin widely reflexed.

Length 55, diam. 25 mill. (*H. Ad.*).

Length 58, diam. 28; longest axis of aperture  $27\frac{1}{2}$  mill.

Length 43, diam. 23; longest axis of aperture 21 mill.

Length 47-50, diam.  $23\frac{1}{2}$  mill. (*Schmacker*).

Formosa: *Tamsui Mts.* (Swinhoe); *Bankintsong*, east of Takow (*Schmacker*); *Lakuli Mts.* in southern Formosa (*Fries*).

*Bulinus* (*Amphidromus*) *formosensis* H. ADAMS, P. Z. S., 1866, p. 317, pl. 33, f. 5.—PFR., Monogr. viii, p. 39.—*Cochlostyla* (*Chrysalis*) *formosensis* PAETEL, Catal., p. 97.—*Amphidromus formosensis* KOBELT, Jahrb. D. M. Ges. vi, 1879, p. 213.—MLLDF., Jahrb. xi, 1884, p. 162; also cf. Bericht Senckenb. Ges. 1893, p. 99.—SCHMACKER & BOETTGER, Nachrichtsbl. D. M. Ges. xxiii, p. 195, 1891.

An extremely variable species in size and markings. The light streaks, as usual in *Euhadra*, most frequently arise at the suture. Sometimes they may be entirely absent; while uniform yellow specimens have been recorded by Schmacker. The spiral dark and light bands are equally variable. In several shells before me the whole base is darker than the upper surface, but one or two creamy lines define bands in the dark surface below the periphery. Fig. 26 is a copy of the original illustration.

The name is pre-occupied in *Eulota*; and if on examination of the anatomy a new one is needed, this species may be called *E. elongata*.

A third species of this group is indicated by a poor dead specimen collected at Kankow, Formosa, by Mr. Schmacker's Japanese collector, and has been noticed by him as "*Amphidromus spec.*" (Nachrbl. 1891, 165). It resembles *swinhoei* in size and form, has spiral lines and three dark bands. On account of the ill-preservation of the specimen, no further description has been published.

#### Genus CALYCIA H. Adams, 1865.

*Calycia* H. AD., P. Z. S., 1865, p. 413.

Shell ovate-conic, thin, perforate or closed, pellucid-whitish, spirally sculptured, the aperture oblique, trapezoidal-ovate, peristome simple

and unexpanded, columellar margin narrowly reflexed above. Mantle blue; foot very broad, apparently having pedal grooves. Jaw (pl. 4, fig. 25) extremely thin, with two weakly indicated ribs in the middle, and a median projection on the concave margin. Radula (pl. 4, figs. 22, 23, 24) with rows of teeth meeting at an angle in the middle; central tooth tricuspid, very narrow, with a long basal plate; side teeth with two cusps, even to the extreme marginals (fig. 24); the cusps of all the teeth broad and rounded. Genitalia (pl. 4, fig. 26) with the penis swollen in the middle and distally, where a short epiphallus is inserted; no flagellum. Duct of the spermatheca extremely short, entering low, close to the atrium; other female organs as usual.

Type, *C. crystallina*. Distribution, New Guinea, and some adjacent, faunally similar, islands. The species are arboreal.

The anatomy of *C. crystallina*, investigated by Mr. G. Schaeko, shows this genus to belong to the *Zonitidae*. The foot has grooves above its lateral margins, so far as one can judge from the published figure; but Schaeko unfortunately fails to mention the structure of the foot-edge. The dentition seems to be essentially Zonitoid, but with the cusps of the teeth broadened, as in arboreal snails generally.

*C. CRYSTALLINA* (Reeve). Pl. 4, figs. 16, 17, 18.

Shell subperforate, ovate-conic, thin, striate, decussated by close spiral sulci; pellucid, glassy-whitish; spire conic, obtuse. Whorls  $5\frac{1}{2}$ , nearly flat, the last a little longer than the spire, more convex, obtusely carinated below the middle. Columella somewhat straightened, brownish, a little reflexed above. Aperture oblique, subtetragonal-oval; peristome simple, unexpanded.

Length 50, diam. 29 mill.; aperture 30 mill. long, 19 wide (*Pfr.*).

New Guinea: *Port Dorey* (Raffray); Maccluer Gulf (Gazelle Exped.); *Sorong Island* (L. M. D'Alberty); *Waighin* (Wallace).

*Bulimus crystallinus* REEVE, Conch. Icon., pl. 32, f. 194 (July, 1848).—*PFR.*, Monogr. iii, p. 389; iv, 451; vi, 90, *Orthalicus crystallinus* H. & A. AD., Genera, ii, p. 154.—*Limicolaria crystallina* SHUTTL., Notitiae Malacol. i, p. 54.—*Calycia crystallina* H. ADAMS, in Wallace, P. Z. S., 1865, p. 412.—TAPPARONE-CANEVARI, Annali Mus. Civ. Genov. xix, p. 100, fig. a; xx, p. 145.—MARTENS, Conch. Mittheil. ii, p. 13; Archiv f. Naturg., 1897, p. 43, pl. 9, f. 4 (shell), f. 1-3, a, b, c, K (soft anatomy, by G. Schaeko); with var. *gracilior*, t. c., p. 44.

Fig. 16 is a copy of Reeve's type figure; fig. 18 from Tapparone-Canefri, and fig. 17 after von Martens, from a small specimen from Maccluer Gulf.

Wallace found it "on tree trunks, the animal green," on Waighiu island. Schacko, who investigated dried specimens, states that the mantle is light blue, columellar margin blue-reddish, the foot yellow and brown. The radula has the formula 350.1.350, with 174 rows of teeth.

A specimen of *C. crystallina* has been reported from the Moluccas by Tapparone Canefri, on the authority of L. M. D'Albertis. It may have been carried there by natives, whose trading journeys cover this whole region.

Var. *gracilior* Martens. Shell imperforate, oblong-conoid, the spiral sulci less close and a little stronger, angle of the last whorl almost wanting, columellar margin white, flatly appressed. Length 45, diam. 27, length of aperture 27, width 17 mill. (*Martens*).

*Sekar, New Guinea* (Ribbe).

*C. ISSELLIANA* Tapparone Canefri. Pl. 4, figs. 19, 20.

Shell imperforate, ovate-conic, *rather solid*, longitudinally striate, decussated by numerous and irregular impressed spiral sulci, glassy-white, *the sulci opaque, milk-white*. Spire conic, the apex densely punctate, rather obtuse. Whorls  $5\frac{1}{2}$ , *subconvex, separated by a deep suture*, the last whorl large, exceeding the height of the spire, a little constricted a short distance below the suture, and very obtusely, very obsoletely subangular below the middle. Aperture oblique, oval, indistinctly quadrangular; columella narrow, brownish, reflexed above; peristome simple, unexpanded. Length 42, diam. 28 mill. (*T. C.*)

New Guinea: *Katow* River, on the south coast (D'Albertis).

*Calycia isselliana* T. C., *Annali Mus. Civ. di Genova*, xix, p. 101, f. b, c (1883).—HEDLEY, P. L. S., N. S. W. (2), vi, p. 97.

Differs from *C. crystallina* in the less elongate form, fewer and opaque white spiral sulci, more convex whorls and deeper suture.

*C. EVERETTI* Smith. Pl. 4, fig. 21.

Shell ovate-conic, angulate at the periphery, narrowly perforate; pellucid white, covered with a glossy greenish cuticle; spire conic, papillose at the apex; whorls  $5\frac{1}{2}$ , rapidly increasing, the earlier 2 or

3 convex, the rest rather flat, with a narrow white line bordering the suture below; obliquely striate and sculptured with obsolete, spiral, impressed lines; the last whorl large, obtusely angular in the middle, malleate or corrugated, and obliquely striate. Aperture inverted ear-shaped, colored like the outside, and two-thirds the length of the shell; peristome white, hardly thickened, lightly expanded, the columellar margin narrowly reflexed over the perforation.

Length 26, diam. 20 mill.; aperture 16 mill. long, 11.5 wide. (*Smith.*)

Celebes: *Bonthain Peak*, in the S. peninsula, at 4000 ft. (A. Everett).

*Calycia everetti* E. A. SMITH, Proc. Malac. Soc. London, ii, p. 98, pl. 7, f. 23 (July, 1896).

"This species is very peculiar, and does not suggest a comparison with any other known form. It hardly agrees with the genus *Calycia* in the expanded character of the peristome, but it appears to approach that group more closely than any other." (*Smith.*)

I have not seen this species, but from the form of the columella and lip, convex early whorls, and greenish cuticle, it seems to belong to the *Beddomea* or *Pseudopartula* stock, rather than to *Calycia*. I do not feel justified, however, in changing the generic position assigned by the sagacious author of the species, without myself seeing the shell; especially as the specific name is pre-occupied in *Amphidromus* (*A. everetti* Fult., Jan., 1896).

#### Genus BOCOURTIA Rochebrune, 1882.

*Bocourtia* ROCHEBR., Bulletin de la Société Philomathique de Paris (7), xvi, 1881-2, p. 117.

Shell imperforate, ovate-oblong, sulcate; whorls subventricose, covered with a tawny epidermis; columella subcallous, curved; aperture ovate elliptical, the lip unexpanded, simple. (*Rochebr.*)

These shells are said by M. Rochebrune to be the exact but exaggerated counterpart of *Linnaea palustris*, from which they differ anatomically, though no details of this are given. The genus, if such it be, is unknown to other authors; and is inserted here merely to complete the account of oriental Bulimi. Rochebrune does not state whether the mollusk is aquatic or terrestrial, but the latter would be implied.

B. LYMNÆFORMIS Rochebrune. Shell imperforate, ovate-elliptical,

solid; violaceous whitish ornamented with brown flames under an evanescent fulvous cuticle; longitudinally sulcate. Spire pyramidal, ovate, the apex subacute, suture deeply undulated. Whorls 6, sub-ventricose, the last more than half the shell's length, compressed at the base. Aperture vertical, elliptical; peristome simple, unexpanded, the columellar margin reflexed; columella thick, subarcuate.

Length 44, diam. 18 mill. (*Rochebr.*, t. c., p. 118).

*Bangkok* (M. Bocourt).

**B. FASCIATA** Rochebrune. Shell imperforate, ovate, subsolid, brown under a chestnut epidermis; spire short, acute, suture deep; whorls 6, longitudinally lamellose, the last ventricose, encircled by a wide white band, exceeding two-thirds the length of the shell, compressed at base. Aperture elongate; peristome simple, subarcuate; columellar margin reflexed; columella straight. Length 22, diam. 14 mill. (*Rochebr.*, l. c.).

*Bangkok* (M. Bocourt).

The types of both species are in the Paris Museum. Neither has been figured.

## Part II.—AMERICAN BULIMULIDÆ.

### Sub-family ODONTOSTOMINÆ.

*Bulimulidæ* in which the aperture is obstructed by internal lamellæ, folds or teeth (rarely absent by degeneration); the base is perforate or has an umbilical suture; and the genitalia are extremely lengthened. Jaw either plaited or solid.

Though difficult of diagnosis, this sub-family is clearly a natural group of genera, confined to South America east of the Andes, and with the exception of one or two species, south of the Amazon. That the whole series had its inception in a form in which the characteristic apertural teeth had already been developed, is demonstrated by the fact that these lamellæ and folds are clearly homologous throughout the species of the several genera. That any such exact correspondence could be due to independent acquisition of these structures is almost incredible. It follows from this that the toothless forms, such as *Moricandia*, are secondarily so, by degeneration of the teeth of their ancestors. Many species show the various stages of tooth-degeneration.

These genera have been placed by Dr. Paul Fischer in the family *Pupidæ*; but their position in the *Bulimulidæ* is unmistakably indicated by the exceedingly short kidney, hardly longer than the peri-

cardium, while in *Pupidæ* the kidney is very long; and by the absence of accessory organs upon the penis, such as are general if not universal in the true *Pupidæ*, as well as in some related families.

Material for any adequate consideration of the soft anatomy of the *Odontostominæ* is not available; but there exist some data upon *Anostoma riugens*, (dissected by Fischer), *Macrodonates odontostomus* and *Odontostomus* (*Spixia*) *punctatissimus* (dissected by myself from specimens supplied by Dr. von Thering), and upon *Plagiodontes* (examined by Dr. A. Doering).

The jaw, though rather thin, is of the smooth type in *Anostoma* (pl. 5, f. 32, 33) and *Macrodonates* (fig. 37). In *Odontostomus*, subgenera *Spixia* (pl. 5, fig. 30) and *Plagiodontes*, it is plaited, with shortly free, over-lapping edges, as in *Bulimulus*.

The dentition is that of ground snails. In *Anostoma* (pl. 5, fig. 39) and *Macrodonates* (fig. 38) the central and lateral teeth have no side cusps, the marginals have an ectocone developed; the basal-plate being short in the former genus, long in the latter. In *Odontostomus punctatissimus* (pl. 5, fig. 31) ectocones are developed on all teeth, and split on the marginals. The enlarged mesocones suggest partially arboreal habits in this species; but they are not so enlarged in *O.* (*Plagiodontes*) *dentatus*. The dentition and jaw of *Anostoma* and *Macrodonates* are rather aberrant for this family, but in *Odontostomus* these organs are normal.

The free muscles are similar in *Macrodonates*, *Bulimulus* (*pallidior*) and *Oxystyla*; the right and left ocular and pedal retractor and the columellar muscle (tail retractor) being free to their common proximal insertion, while the buccal retractor is united with the left ocular for an extremely short distance.

The pallial organs have been examined in *Macrodonates* and *Odontostomus* only. In both, the exceedingly short, triangular kidney is like that of *Bulimulus*, *Oxystyla*, etc.; and as in other groups of land snails, the length of the kidney bears no constant relation to that of the lung, but should be compared with the length of the pericardium. The secondary ureter seems to be closed in *O. punctatissimus*, but open and merely a slightly differentiated band in *Macrodonates*. In *O. punctatissimus* (pl. 15, fig. 26, kidney at *k*) the lung is exceedingly long and narrow, even more so than usual in *Oxystyla* and *Bulimulus*; there is but one pulmonary vein, or if others are present they are minute, the cardiac side of the lung having

no large vessels, coarse reticulation being confined to the two ends of the lung, (fine transverse venation of the intermediate space being omitted in the figure). In *Macrodonates* (pl. 15, fig. 29), the lung is short, a modification correlated with the reduced number of whorls of the shell. There is a strong secondary pulmonary vein, and a small tertiary, the cardiac side of the lung having a strong, branching venation, while on the intestinal side the venation is fine, close and mainly transverse. The pattern of lung venation in *Macrodonates* is unusual, and I have seen nothing like it elsewhere in the *Bulimulidæ*. It reminds me of *Strophocheilus* and the *Acavidæ*.

The genitalia are exceedingly lengthened in *Odontostomus* and *Auostoma*, much less so in *Macrodonates*. There are no accessories, the whole apparatus being Bulimuline.

*Shell.* The heliciform groups of *Bulimulinæ*, such as *Platybostryx* and *Oxychona*, prepare us for shortened shell-contours in the *Odontostominæ*. In *Tomigerus* the modification is not great; but *Auostoma* presents a form so bizarre that in the total absence of information upon its life history, no useful theory can be formulated to account for its peculiarities.

The apical sculpture in *Odontostominæ* varies within the same wide limits observed in *Bulimulinæ*, and presents nearly identical patterns. In *Auostoma*, *Tomigerus* and *Auctus* the apex is smooth, as in the *Bostryx* type of *Bulimulinæ*. In *Macrodonates* (pl. 15, fig. 30) it is spirally lirate. In *Odontostomus*, including the sections *Moricandia*, *Bahiensis* (pl. 15, f. 31) and *Cyclodontina*, it is like that of *Drymaeus*. In *Hyperaulax* and *O. (Plagiodontes) dentatus* (pl. 15, f. 25) the apex has waved wrinkles as in typical *Bulimulus*, while in *Spixia* (pl. 15, fig. 34) and the other species of *Plagiodontes* (pl. 15, fig. 32) there are straight riblets like those of *Orthotomium*, *Næsiotus*, etc. There is an incomplete transition from the *Drymaeus* type to the *Spixia* type by the growing predominance of vertical, with gradual loss of spiral sculpture, exemplified in some species.

The teeth obstructing the apertures of the *Odontostominæ* are far more stable in position and arrangement than would be thought on first inspection. They may most readily be described by use of the terminology of the similar teeth of *Pupidæ*.

*Lamellæ on the parietal wall:* Angular, parietal and infraparietal lamellæ.

*Lamellæ on the columellar margin:* Supracolumellar, columellar and sub-columellar lamellæ; basal fold.



*Folds within the outer lip* : Sutural, suprapalatal, upper palatal and lower palatal folds.

In *Tomigerus* (fig. 4) and *Anostoma* (fig. 3), the primitive con-

FIG. 1.

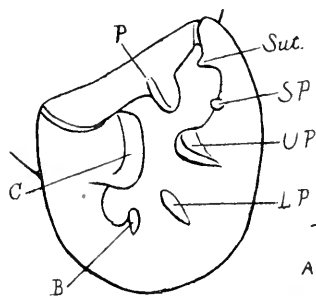


FIG. 2.

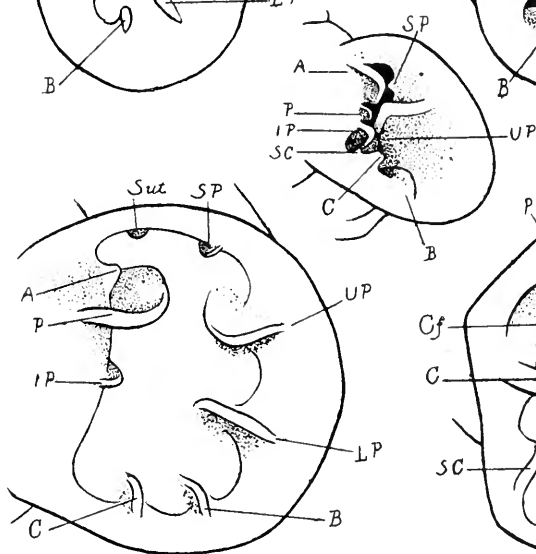
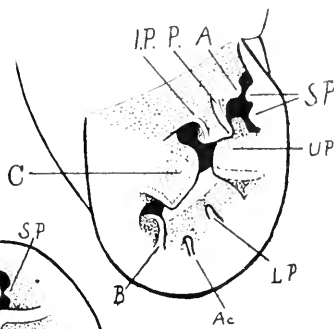


FIG. 3.

FIG. 4.

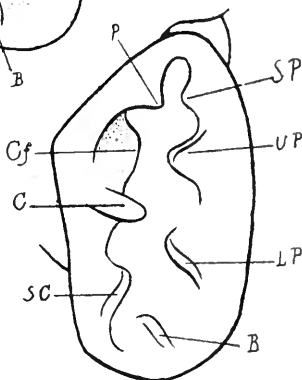


FIG. 5.

FIG. 1, *Odontostomus* (*Cyclodontina*) *pupoides*. FIG. 2, *O.* (*Plagiodontes*) *dentatus*. FIG. 3, *Anostoma*. FIG. 4, *Tomigerus* *turbinatus*. FIG. 5, *Macrodon* *odontostomus*. A, angular lamella; Ac, intrapalatal fold; B, basal fold; C, columellar lamella; Cf, fold of the columella; IP, intraparietal lamella; LP, lower palatal fold; P, parietal lamella; SC (in Fig. 5), subcolumellar lamella (in Fig. 4), supracolumellar lamella; SP, suprapalatal fold; Sut., sutural fold; UP, upper palatal fold.

dition of the parietal armature remains, the angular, parietal and intraparietal lamellæ being all present and separate. In *Hyperaulax ramagei* the parietal lamella is absent, the other two remaining.

Finally, *Plagiodontes* (fig. 2) has the three parietal lamellæ united into a single compound tooth, though the original elements are separate at a certain stage of growth, as shown in pl. 15, fig. 33. In *Anostoma* the parietal lamella is the longest and most deeply entering in the other groups mentioned the infraparietal is longest.

In other groups of the sub-family, only a single lamella, which seems to be the parietal, stands upon the parietal wall, with the exception of a form of *Odontostomus punctatissimus*, which retains the minute angular lamella.

The basal fold is usually situated at or upon the lower end of the columellar margin, rather than in a strictly basal position; and in many species of *Odontostomus* the lower palatal fold is basal in situation. In *Macrodontes* it is rather high. The upper palatal fold is almost always larger than the lower, and is directly opposite the fold of the columella, though frequently above the columellar lamella. In *Tomigerus* the upper palatal fold is a wide, obliquely-entering plate, and there seems to be no lower palatal. Finally, in most species of *Plagiodontes* there is a transverse, erect plate within the throat, which may be homologous with the lower end of the entering palatal of *Tomigerus*.

The following key is based upon obvious structures of the shell, not always the most important generic characters.

*Key to Genera of Odontostominæ.*

- I. Shell heliciform, biconvex, with the last whorl traversing the base, the aperture turned upward, semicircular and toothed.  
ANOSTOMA.
- II. Shell turbinate or ovate, wider than high, with a long basal suture; aperture lateral, the parietal wall bearing angular, parietal and infraparietal lamellæ, baso-columellar lip with three folds, outer lip with a single oblique plate within.  
TOMIGERUS.
- III. Shell ovate or turreted, much longer than wide.
  - a. Apex smooth; aperture narrow, the reflexed outer and inner lips built forward, parallel; throat without laminae or folds.  
ANCTUS.
  - a<sup>1</sup>. Apex with vertical or grated sculpture; aperture ovate or oblong, usually contracted by lamellæ and folds, the parietal, when present, always compressed and entering.  
ODONTOSTOMUS.

$a^2$ . Apex spirally lirate; aperture oblong, toothed, the peristome free throughout, parietal tooth marginal, tuberculiform, not entering; whorls few,  $5-6\frac{1}{2}$ .

MACRODONTES, p. 29.

Genus MACRODONTES, Swainson, 1840.

*Macrodon* SWAINSON, Malacology, p. 334, type and sole species *M. sowerbegeri* Sw. = *O. odontostomus* Sowb.

Shell umbilicate, oblong, striate and decussate, composed of  $5-6\frac{1}{2}$  convex whorls, the first  $1\frac{1}{2}$  *spirally lirulate*, the last *becoming free in front*, keeled at the base. Aperture channeled below, obstructed by a *marginal and tubercular parietal tooth*, a columellar fold bearing a transverse lamella below, a subcolumellar lamella, basal, upper and lower palatal folds, and a suprapalatal fold; part or all of the teeth sometimes degenerate or subobsolete; peristome continuous, free and reflexed throughout.

The jaw (pl. 5, fig. 37, *M. odontostomus*) is stout, arcuate and smooth, showing faint vertical striae and under very high magnification. The teeth (pl. 5, fig. 38) have simple mesocones in the median part of the radula, the inner marginals adding an ectocone. The outer marginal teeth were lost from my preparation.

The reproductive system (pl. 15, fig. 28, *M. odontostomus*) is simple, the organs shorter than in *Odontostomus punctatissimus*. The long penis has a terminal retractor muscle and vas deferens. The vagina is long, spermatheca oval on a rather long duct. The lower portion of the hermaphrodite duct is pressed into and imbedded in the albumen gland for the whole length of the latter, being visible on its concave face. Length of penis  $17\frac{1}{2}$ , of vagina 6, of spermatheca with duct 11 mill.

Free retractor muscles: Right and left ocular and anterior foot retractor bands, and the columellar muscle, separate except immediately at their proximal insertions; retractor of the buccal mass united with the left ocular band for a very short distance proximally. The right eye retractor passes between branches of the genitalia.

The lung (pl. 15, fig. 29) is rather short, closely veined throughout, the venation strongest on the cardiac side, the secondary pulmonary vein well developed. Kidney triangular, short, hardly extending forward beyond the pericardium. Secondary ureter wholly open.

Distribution, southern Brazil.

The lamellæ and folds vary from very large in some species to mere vestiges in others.

The genus *Macrodon* has hitherto been considered a subgenus of *Odontostomus*, but it differs in the following characters: The shell has fewer whorls, *spirobly lirata apex* with no vertical striæ, and a marginal, tubercular parietal tooth in place of an entering lamella. The genital system is far less elongate. The lung is *short, densely reticulate on the cardiac side*, with strong secondary and tertiary pulmonary veins developed. The secondary ureter is wholly open, but slightly differentiated. The jaw is *smooth*. Finally, the central and lateral teeth are unicuspid. These several differences clearly entitle *Macrodon* to generic distinction. In the soft anatomy, but not in the shell, it approaches *Anostoma*. In the pattern of lung venation it departs from the *Bulinulidæ* generally.

*Key to Species of Macrodon.*

1. Aperture oblong, exceeding a third of the shell's length; ground-color brown.
  - a. Basal keel long and curved, somewhat lateral; plain or banded; teeth well developed.
    - b. Aperture pink, its width contained  $1\frac{1}{2}$  times in its length; uniform reddish-brown. *odontostomus*.
    - b.<sup>1</sup> Aperture dark within, its length nearly double the width; the lip white or bluish, with two angles on the left side.
      - c. Uniform cinnamon-brown; length 35, diam. 11 mill. *grayanus*.
      - c.<sup>1</sup> With many whitish lines on a dark ground; length 38-40 mill. *fasciatus*.
  - a.<sup>1</sup> Basal keel short, median and subvertical when viewed from the back, and but slightly arcuate; plain or striped.
    - b. Aperture narrow, nearly filled with large teeth; length of shell fully 3 times its diam. *paulistus*.
    - b.<sup>1</sup> Aperture open, with the teeth very small or obsolete; form obese. *dautzenbergianus*.
2. Aperture squarish-ovate, about one-third the length of the shell; color yellowish-green; basal keel short, teeth subobsolete. *degeneratus*.

*M. odontostomus* (Sowerby). Pl. 13, figs. 85, 86, 87.

Shell rimate-perforate, cylindric-fusiform, solid, uniform light chestnut-brown; surface somewhat glossy, densely and sharply striated obliquely, and seen under a lens to be closely cut by spiral lines. Whorls about  $6\frac{1}{2}$ , convex, rapidly increasing, the last becoming free in front, impressed behind the outer lip, with three pits in the impression, the latter half of the base pinched into a very strong though blunt keel, defining a flat basal area, pitted behind the lip, and separated from the umbilical excavation by a shorter keel. Umbilical cavity ample. Aperture oblique, oblong, obstructed by 8 lamella and folds: a marginal, triangular tooth on the straight parietal margin, an oblique, slightly calloused columellar plication, crossed below by a transverse columellar lamella, a blunt, low-conic basal fold, and within the outer lip three compressed folds, the median (upper palatal) obliquely descending as it passes inward, the lower palatal entering, the suprapalatal small. Peristome pink or lilac-tinted, broadly expanded and reflexed and completely free throughout.

Length 38, diam. 12, longest axis of aperture 14 mill.

Length  $35-37\frac{1}{2}$ , diam.  $13\frac{1}{2}$ , longest axis of aperture  $13\frac{1}{2}$  mill.

Brazil: *Corcovado* near Rio Janeiro, and *Macache* (Paz).

*Bulimus odontostoma* Sowb., Zoological Journal, i, p. 59, pl. 5, f. 3 (1824).—REEVE, Conch. Icon., pl. 38, f. 228.—PERC., Monogr. ii, p. 82; iii, 367; iv, 435; vi, 75; Conchyl. Cab., p. 138, pl. 16, f. 1-3.—HIDALGO, Journ. de Conchyl. 1870, p. 51.—*Helix odontostoma* WOOD, Ind. Testac. Suppl., pl. 7, f. 28.—*Pupa odontostoma* GRAY, Ann. of Philos., n. ser., ix, p. 413.—DESHAYES in FÉR., Histoire, ii, p. 204, pl. 163, f. 1.—*Macrodonates odontostomus* Sowb., W. G. BIXNEY, Ann. N. Y. Acad. Sci., ii, p. 114, pl. 10, f. n (jaw and dentition).—*Pupa erythrostoma* MENKE, Synopsis, edit. 2, p. 32, 1830 (new name for *B. odontostoma* Sowb.).—*Clausilia gargantua* DESH. in Lam., An. s. Vert., viii, p. 214.—*Odontostomus gargantula* BECK, Index, p. 54.—*Macrodonates sowerbeyii* SWAINS., Malacology, p. 334 (1840).

The pink aperture is broader and shorter than in the other species with a long, areolate, basal keel, and it is less closed by the teeth.

This species has been supposed to be the *Helix gargantua* of Férussac, but the original description, "Bouche armée de gros plis ou dents alongées . . . Coquille aussi rare que singulière, de plus de deux pouces de longueur," indicates that the original *gargantua* was *O. pantagruelinus*.

*M. GRAYANUS* (Pfeiffer). Pl. 13, fig. 88.

Shell slender, turreted, rather solid, longitudinally very finely striated and somewhat decussated by spiral impressed lines, cinnamon colored. Spire turreted, the apex very much attenuated. Whorls 6, slightly convex, the last about two-fifths the total length, deflexed in front and becoming free from the preceding, carinated at the top and base, having pits along the side. Aperture narrow, oblong, channeled at the base; peristome simple, expanded throughout, having 7 teeth within, three within the right margin, four within the left, the upper one tubercle-shaped, the second strong and lamelliform. Length 35, diam. 11, aperture 14 mill. long, 7 wide (*Pfr.*).

Brazil (*Pfr.*); *Theresopolis* (Fruhstorfer).

*Bulinus grayanus* PER., P. Z. S., 1845, p. 73; Monogr. ii, p. 83.—REEVE, Conch. Icon. pl. 38, f. 229.—*Odontostomus grayanus* H. & A. AD., Genera ii, p. 152.—*Bulinus* (*Macrodon*) *grayanus* Pfr., BOETTGER, Nachrbl. d. D. Malak. Ges. 1889, p. 30.

Var. *FASCIATUS* ('Dohrn' Pfeiffer). Pl. 13, figs. 89, 90, 91, 92.

Shell umbilicate and rimate, solid, fusiform, very dark chestnut-brown *encircled with many white, hydrophanous lines and bands*; densely finely striate, and decussated by minute spirals cutting the tops of the striae. Whorls  $6\frac{1}{2}$ , moderately convex, the last shortly free in front, contracted behind the outer lip, with three pits in the depression; acutely carinate at the base, concave above the carina, flattened to the left of it and with a pit behind the basal lip; umbilicus deeply excavated. Aperture vertical, angularly oblong, black-brown inside, the parietal and basal margins slanting, straight, the columellar margin vertical, concave, the outer margin regularly arcuate; almost closed by 8 large teeth, white at their summits: a marginal parietal tubercle, a deeply-immersed columellar fold, crossed below by a strong, entering columellar lamella, a smaller subcolumellar lamella, and a compressed basal fold; within the outer lip three compressed folds, the upper palatal oblique, angular and twisted, situated above the middle of the lip, the superpalatal small and transverse. Peristome broadly expanded, reflexed, white or blue-white.

Length  $38\frac{1}{2}$ , diam. 13, length of aperture  $15\frac{1}{3}$ , width in the middle 8 mill.

Length 40, diam.  $12\frac{1}{2}$  mill. (*Pfr.*)

Brazil: *Sta. Catharina* (Dohrn).

*Bulinus grayanus* Pfr. var.? (*Bul. odontostomus* var. *fasciata* Dohrn on label) PFR., Novit. Conch. iii, p. 473, pl. 102, f. 16, 17 (1869).

This form may prove specifically distinct from *M. grayanus*. It is larger, less fusiform, and constantly multilineate with cream-white, the two specimens examined by Pfeiffer and two before me agreeing in these features. However, the white lines are cuticular, produced by air pores, as in the Philippine *Helicostylas*; so they may possibly have been originally present and rubbed off of the type of *grayanus*. The teeth are far more strongly developed than in *M. odontostomus*.

*M. PAULISTUS* Pilsbry & v. Ihering. Pl. 13, figs. 93, 94.

Shell lengthened fusiform; rather solid; reddish chestnut, with irregular, lacerated and somewhat zigzag, obliquely longitudinal, hydrophanous, cream-tinted, speckled streaks. Surface dull, very minutely but sharply striated in the direction of growth lines, a strong lens showing much more minute and superficial, dense, spiral striation, the apical whorls spirally lirate. Whorls 6, the first turned in, the rest rather rapidly and regularly increasing, moderately convex, the last becoming free at the aperture, compressed behind the outer lip, the trench there impressed by five unequal pits; base pinched into an acute, produced, nearly straight, keel; and behind the columellar lip there are two pits and a deep axial pit, with another shallow pit behind the elevated parietal wall. Aperture purplish within, slightly oblique, narrow, irregularly oblong, obstructed by eight pliciform teeth and a strong, deep-seated columellar fold; the teeth being arranged as in *M. grayanus fasciatus*, except that the palatal folds are not twisted, the lower one runs obliquely upward, and there is a small interpalatal fold in the middle of the outer lip between the upper and lower palatals. Peristome continuous, white, reflexed throughout.

Length 37, diam. 12 mill.; length of aperture (including peristome) 15, width 8 mill.

Brazil: *Iguape*, prov. S. Paulo (Dr. H. von Ihering).

*O. (Macrodontes) paulista* P. & v. I., Proc. Acad. Nat. Sci. Phila., 1898, p. 471 (Dec. 12, 1898).

This most beautiful of the *Macrodontes* species has hydrophanous cuticular markings somewhat like *Anris huxwelli* (Crosse). It differs conspicuously from the well known *M. odontostomus* in the more

slender contour, basal instead of baso-peripheral position of the keel, which is nearly straight instead of being spirally curved, and in the longer and narrower aperture, which is consequently more filled by the large teeth. There is also one more tooth than in *M. odontostomus* or *M. grayanus fasciatus*, and the striation is much finer. *M. grayanus* differs strongly in the less tapering and quite differently-shaped base, as well as in lacking the median tooth of the outer lip, and in coloration; but the angular outline and narrow form of the aperture are similar.

*M. DAUTZENBERGIANUS* Pilsbry. Pl. 13, figs. 95, 96, 97.

Shell oblong-ovate, thin, light chestnut with a golden sheen, and sparse, narrow, oblique or zigzag creamy hydrophanous markings (absent on some specimens); surface dull, with very minute but regular and sharp striation along the lines of growth, and much finer, shallower, close spiral lines; the apical  $1\frac{3}{4}$  whorls delicately spirally lirulate. Whorls 5, the first with in-turned tip, the rest rapidly increasing, convex, the last becoming very shortly free at the aperture, somewhat compressed behind the outer lip, and with three small pits there; the base pinched into a short, strong keel; behind the columellar lip two-pitted, with a deep umbilical fissure. Aperture irregularly oblong; peristome continuous, flesh-colored, narrowly reflexed, orange-brown within, the upper margin with a small blunt tooth, outer lip with four small or minute tubercular teeth within, the lowest low and wide, the upper two (upper palatal and suprapalatal) minute and acute, whitish; basal lip with one low, wide tooth, the columella with a strong oblique fold upon which a minute whitish denticle is placed, another one being situated below the columellar fold.

Alt. 26, diam.  $11\frac{1}{2}$  mill.; length of aperture 12, width 7 mill. (including peristome).

Brazil: *Raiz de Serra*, Prov. *Sao Paulo* (Dr. H. von Ihering).

*O. (Macrodontes) dautzenbergianus* PILSBRY, Proc. Acad. Nat. Sci. Phila., 1898, p. 472 (Dec. 12, 1898).

This species, to which we have attached the name of a distinguished French conchologist, is obviously a *Macrodontes*, agreeing with the species of that genus in the positions of the denticles; but in our species the armature of the aperture has degenerated to a series of very small denticles. For the rest, the form is more obese than any other known *Macrodontes*.



A specimen from Cubatão, São Paulo (pl. 13, fig. 97), differs from the type in being darker colored, of a dark reddish-chestnut hue, somewhat more solid, with the denticles on the outer lip and columellar margin subobsolete, hardly noticeable, and of the reddish color of the lip itself; the pits behind the lip are correspondingly obsolete, but there are two minute white denticles on the columellar fold. This shell measures: alt. 26, diam. 10 mill.; length of aperture 11, width  $6\frac{1}{2}$  mill.

*M. DEGENERATUS* Pilsbry. Pl. 13, figs. 98, 99.

Shell oblong-turreted, perforate and rimate, thin but moderately strong, *pale yellowish-green*. Surface hardly shining, striated in the direction of growth-lines, the striae hardly visible without the aid of a lens, under which they are seen to be thread-like, well raised, finely but rather superficially cut into beads by decussating spirals which crenulate the summits of the striae. Spire convexly conic, the apex obtuse; whorls  $5\frac{3}{4}$ , quite convex, the earlier  $1\frac{1}{2}$  densely striated spirally, the last whorl becoming free and somewhat descending in front, constricted and showing 3 small pits behind the outer lip, bicarinate at base, the keels short, outer one strongly pinched up, the inner low, rounded, a distinct depression between them. Aperture oblique, squarish-oblong, nearly one-third the total length of the shell, obstructed by a strong columellar fold which bears a transverse lamella below, and by 6 small, tuberculiform sub-obsolete teeth: one upon the parietal margin close to its posterior termination, three upon the outer lip, the uppermost (suprapalatal) quite small, and with the parietal denticle, defining a small rounded posterior sinus or notch, the upper and lower palatal folds low, removed from the lip-edge; basal fold median; a small subcolumellar tooth below the transverse columellar lamella. Peristome white, narrowly reflexed, continuous and free throughout. Alt.  $21\frac{1}{2}$ , greatest diam.  $8\frac{1}{2}$ , length of aperture 7 mill.

Brazil: *Palmeiras*, Province of Paraná, (Dr. H. von Ihering).

*O. (Macrodonates) degeneratus* PILSB., Proc. Acad. Nat. Sci., Phila., 1898, p. 473 (Jan. 13, 1899).

Very unlike other known species in the pale green color and short aperture with degenerate teeth.

## Genus ANCTUS v. Martens, 1860.

*Anctus* v. MART. in Albers' Die Hel. (2 edit.), p. 214 (November, 1860!), type and sole species "*B. anchistomus* Wagn. = *B. angio-stomus* Wagner.—*Gonyostomus* sp., ALBERS, 1850.—*Stenostoma* sp., SPIN 1827 (preoc.).

Shell ovate-conic, of numerous (7–8) whorls, the last ascending in front, the aperture built forward, forming a wide umbilical area and long rima or umbilical suture. Apex smooth. Aperture over half the shell's length, narrow and parallel-sided, without lamellae or folds within; the peristome narrowly reflexed, thickened within. Soft anatomy unknown.

The two species known are from the mountains of Bahia province, Brazil. Both are white shells, conspicuously striped with brown and black, and remarkable for their narrow apertures; the end gained in *Odontostomus* by the development of tooth-like processes being here attained by a lateral compression or strangling of the whole mouth, as the generic name denotes.

The color-scheme of stripes (compare *O. inflatus* Wagn., *dubiosus* Jay) and the long umbilical suture, as well as the crowded whorls of the spire, are all features commonly encountered in *Odontostomus*; and there is every reason to believe that when the scalpel lays bare the internal organization of *Anctus*, it will prove to resemble closely such species of *Odontostomus* as *dubiosus*, *angulatus* and their allies. The chief difference from *Odontostomus* is that the apex is smooth; but still I think that if no more weighty divergence is found in the soft parts, *Anctus* might advantageously be reduced to a subgenus of *Odontostomus*.

## A. ANGIOSTOMUS (Wagner). Pl. 8, fig. 86.

Shell ovate-conic, having a long, deep and oblique umbilical rimation, thin but rather strong; opaque white, striped longitudinally with mingled brown and black narrow stripes, which taper above on the spire, and are often partially interrupted by a light peripheral line. Surface striated. Spire straightly conic, the apex corneous-brown, obtuse, smooth. Whorls  $7\frac{1}{2}$ , slightly convex, the last narrow at the base, the suture ascending in front. Aperture vertical, very narrow and parallel-sided, more than half as long as the shell, light brown inside; peristome white, narrowly reflexed, evenly thickened within, the outer and columellar margins parallel.

Length  $25\frac{1}{2}$ , diam. 11, length of aperture incl. perist. 14, width 5 mill.

Length  $20\frac{1}{2}$ , diam.  $10\frac{1}{2}$ , length of aperture incl. perist.  $13\frac{3}{4}$ , width  $5\frac{1}{4}$  mill.

Brazil: *Wood of Capueira* (Spix); *Mountains of Jacobina*, in the northern part of Bahia province (Moricand), living in pastures.

*Bulinus angiosomus* WAGNER, Testac. Bras., p. 14 (1827).—POTIEZ & MICHAUD, Galerie, i, p. 132, pl. 12, f. 5, 6.—KÜSTER, Conchyl. Cab. p. 44, pl. 13, f. 12–14.—REEVE, Conch. Icon. pl. 48, f. 312.—DESH., Histoire, p. 75, pl. 145, f. 3, 4.—FER., Monogr. ii, p. 97; iii, 375; iv, 445; vi, 80.—*Bulinus (Gonyostomus) angiosomus* ALBERS, Die Hel., p. 150.—*Anctus angiosoma* FORD, Proc. Acad. Nat. Sci., Phila., 1891, p. 97, f. 2; Nautilus iv, p. 135, f. 2.—*Bulinulus (Anctus) auchistomus* Wagn., MARTENS in Alb., Die Hel., 1860, p. 214.—*Stenostoma capueira* SPIX Test. Bras., pl. 13, f. 4.—*Bulinus capueira* DESH. in Lam., An. s. Vert. viii, p. 239.—*Bulinulus capueira* BECK, Index Moll. p. 64.—*Bulinulus (Anctus) capueira* FER.—CLESS., Nomencl. Hel. Viv., p. 241 (1878).—*Helix capueira* MORIC., Mém. Genève, vii, p. 435.—*Bulinus virgatus* SPIX, t. c., pl. 6, f. 4.

Varies somewhat in contour, and the outer lip may be either of even width or slightly thicker in the middle. In about 20 specimens I have seen, the apex is either pale or reddish; but Wagner mentions that in the type it is black-brown.

A. LAMINIFERUS (Ancy). Pl. 8, fig. 87.

Similar to *A. angiosomus* but differing in the narrower aperture. The columellar lip is more thickened in the middle, and the outer lip bears a well-defined flange projecting toward the columella, situated at and below the middle; the lip being narrow for a third of its length above the flange, and for a much shorter distance below it. Whorls  $7\frac{1}{2}$  to 8, the first two black.

Length 23, diam. 10; aperture incl. perist.  $12\frac{1}{2} \times 4$ ; inside 1 mill. wide in the middle.

Length 24.7, diam. 10; aperture incl. perist.  $13 \times 4.2$ ; inside 1 mill. wide in the middle.

Length 22.7, diam. 11.7; aperture incl. perist.  $13.3 \times 4.5$ ; inside 1.5 mill. wide in the middle.

Length 20, diam. 10 ; aperture incl. perist.  $11 \times 3.7$  ; inside 1 mill. wide in the middle.

*Brazil.*

*Bulimulus angustomus* var. *laminifera* ANCEY, Le Naturaliste (Ser. 2), x, p. 15, woodcut (1888)—*B. capueira* Spix, var. *laminifera* ANCEY, The British Naturalist, April, 1891, p. 63.—*Anctus pilsbryi* FORD, Proc. Acad. Nat. Sci., Phila., 1891, p. 97, f. 1 (March 10, 1891); Nautilus iv, p. 134, f. 1 (April, 1891).

I have observed no intermediate forms between *A. laminiferus* and *angustomus*, and think them quite distinct species.

Genus ODONTOSTOMUS Beek, 1837.

*Odontostomus* BECK, Index Moll., p. 54 (except first species). Not *Odontostoma* TARTON, Enumeration of Marine Shells found on the Devonshire Coast (1829), so quoted by Jeffreys, Brit. Conch., iv, p. 108. Not *Odontostomus* COCCO, Nuovi Annali delle Scienze Naturali, anno 1, Tomo 2, p. 192 (1838), a genus of fishes.

Shell rimate, bulimoid, oblong, ovate or turreted, composed of 6–12 whorls, the apex vertically wrinkled, costate, or decussate-pitted. Aperture open or obstructed by lamellæ and folds, the parietal lamella when present compressed and entering or twisted, never marginal; peristome expanded or reflexed, adnate to preceding whorl (except in s. g. *Scalvinella*), the columellar lip dilated and free.

The jaw (pl. 5, fig. 30, *O. punctatissimus*) is plaited, as in *Bulimulidæ* generally, its component laminae shortly free at their imbricating outer edges. The teeth (pl. 5, fig. 31, *O. punctatissimus*) have ectocones on central and laterals, the marginal teeth with the ectocone split into two distinct denticles. (Formula for *O. punc.*, 17. 11. 1. 11. 17.)

Reproductive system (pl. 15, fig. 27, lower portion only, *O. punctatissimus*) with all organs excessively lengthened. Retractor muscle terminal on the very long penis; spermatheca globular, lying close to the heart.

Lung (pl. 15, fig. 26, *O. punctatissimus*) extremely long, fully eight times the length of the pericardium, with exceedingly fine venation, chiefly transverse, throughout, coarser near the pneumostome and kidney. No noticeable secondary pulmonary vein, the long primary vein without large branches. Kidney as short as the

pericardium, triangular. Ureter and secondary ureter closed throughout.

The right ocular retractor passes between branches of genitalia.

Distribution, eastern South America, Brazil below the Amazon to northern Patagonia.

A genus presenting great variation in form of the shell and development of apertural teeth. Through the section *Moricandia* it approaches *Auctus*; through *Plagiodontes*, *Tomigerus*; while there are several species with simple apertures, by degeneration of the teeth, which are difficult to separate from *Bulimulus* or *Drymaeus*. The apical sculpture in the typical subgenus is identical with that of *Drymaeus*, while in the subgenus *Spixia* it resembles *Orthotomium*, and in *Hyperantax* and some *Plagiodontes* it is like that of typical *Bulimulus*. Unlike those genera of *Bulimulinae*, we have transition forms of apical sculpture in *Odontostomus*, to some extent connecting the several types.

According to Jeffreys, there is an earlier name, *Odontostoma* of Turton (1829), proposed as an emendation of *Odostomia*, but I have been unable to find the paper cited by him, and no other author or bibliographer seems to be aware of its existence. Under the circumstances it seems needless to dispute the validity of Beck's *Odontostomus*, especially as the two names differ in gender, an invariable element in generic nomenclature. *Odontostoma* and *Odontostomus* have both been used for other groups later than the date of Beck.

Gray selected "*Hel. gargantula*" as the type of the genus *Odontostomus* in 1847 (P. Z. S., p. 174), Beck's *gargantula* being the *odontostomus* of Sowerby. But previous to this, in 1840, that species had been made the type of *Macrodonates*, rendering Gray's selection unlawful. About the same time Herrmannsen, in the *Indicis Generum Malacozoorum Primordia*, ii, p. 138, gave "*Helix gargantua* Fér." as type of *Odontostomus*. This restricts that genus to the allies of *O. pantagruelinus*, which is identical with Férussac's species.

#### *Subgenera and Sections of Odontostomus.*

#### I. Aperture without teeth or folds of any kind.

##### a. Aperture angular or having a "spout" at the base.

Sect. *Moricandia*, p. 40.

##### a.<sup>1</sup> Aperture ovate, rounded below, species of sections *Bahiensis*, p. 46; *Spixia*, p. 66; *Odontostomus*, p. 62.

II. Aperture armed with teeth, or at least a columellar fold or lamella.

*a.* Parietal lamella twisted and angular, composite; shell cylindric-ovate, S.-g. *Plagiodontes*.

*a.*<sup>1</sup> Two teeth on the parietal wall, rarely wanting; single stout teeth on the columellar and on the palatal margins; shell short, *Partula*-shaped, with less than 5 whorls.

Sect. *Bonnaninus*.

*a.*<sup>2</sup> Parietal lamella simple.

*b.* Peristome free and continuous; whorls about 10.

S. g. *Scalarinella*.

*b.*<sup>1</sup> Peristome adnate, the parietal margin thin.

*c.* A groove or gutter at both ends of peristome; a sutural fold developed.

Sect. *Cyclodontina*, p. 58.

*c.*<sup>1</sup> No such grooves at ends of the peristome.

*d.* Apex with minute grated or pitted sculpture.

*e.* Folds within the outer lip compressed, entering; rather thin, moderate sized or small species.

Sect. *Bahiensis*, p. 46.

*e.*<sup>1</sup> Large and solid species.

Sect. *Odontostomus*, p. 62.

*d.*<sup>1</sup> Apex vertically costulate.

S. g. *Spixia*, p. 66.

This key is quite artificial, being based upon the most obvious rather than the most stable characters. The relations of the groups may be better expressed by their sequence below.

Section *Moricandia* Pilsbry & Vanatta, 1898.

*Moricandia* P. & V., *Nautilus* xii, p. 57 (Sept. 1, 1898), type *fusiformis* Rang = *dubiosus* Jay.

Fusiform species with 7-9 whorls, the last tapering and prolonged below, the apex with minute, even, grating of spiral and vertical riblets. *Aperture angular or prolonged below in a "spout,"* wholly without teeth or lamellae other than a low, vertical columellar fold; outer lip narrowly expanded. Type *O. dubiosus* Jay.

Distribution, Sao Paulo to Pernambuco, Brazil, in the mountainous interior. Named for STEFANO MORICAND, an able expositor of Brazilian conchology and botany.

This group has evidently been derived from toothed forms with similar apical sculpture, and in my opinion has no real kinship with the angle-based forms of *Auris*, such as *A. gonistoma*, or with similarly angular species of *Drymaeus*; though the latter genus has the same apical sculpture. The dark streak behind the lip, noticeable in several of the species, is common to part of this group, and of *Bahiensis* and typical *Odontostomus*; and apparently was present in their common ancestor, though now lost in some species of each of these groups.

*Key to Species of Moricandia.*

- I. Length of aperture exceeding half that of the shell; white, uniform or with spiral bands; basal spout long, *bouvieri*, p. 45.
- II. Aperture less than half the length of the shell.
  - a. Slender; length more than 3 times the diameter.
    - b. Aperture with a broad spout below.
      - c. Smoothish, streaked; alt. 40, diam. 10-12 mill.  
*dubiosus*, p. 41.
      - c.<sup>1</sup> Reticulate-malleate and finely striate spirally;  
30 x 9 mill., *nusutus*, p. 44.
    - b.<sup>1</sup> Aperture angular below; 29 x 9 mill.,  
*angulatus*, p. 42.
  - a.<sup>1</sup> Length less than 3 times the diameter.
    - b. Suture not crenulate.
      - c. Outer lip arcuate, *angulatus*, p. 42; *fidænsis*, p. 44.
      - c.<sup>1</sup> Both lips sinuous, *auriscerrina*, p. 42.
    - b.<sup>1</sup> Suture crenulate, brown-spotted; sharply striatulate and spirally striate, *willi*, p. 44.

O. DUBIOSUS (Jay). Pl. 9, figs. 1, 2.

Shell deeply rimate, fusiform, slender and long, rather thin, corneous, with narrow distant brown streaks and a purplish-black stripe behind the white lip. Nearly smooth, the growth-lines fine and inconspicuous. Spire very long, with slightly convex outlines, apex obtuse. Whorls 9, slightly convex, the last tapering downward, narrow and drawn out below. Aperture slightly oblique, narrow, white with a blackish stripe within the lip; peristome white, the outer lip but slightly expanded, strongly arcuate above, sinuous

below: columella oblique, uneven, the columellar lip very broadly dilated above, sinuous; base effuse, narrow and spout-like.

Length 40, diam. 10; length of aperture 15.6 mill.

Brazil: *Province of Minas Geraes* (Rang.), Bahia (v. Ihering).

*Helix fusiformis* RANG, Ann. des Sci. Naturelles, xxiv, p. 60, pl. 3, f. 2 (1831).—*Bulinus fusiformis* PFR., Symbolæ, i, p. 82; ii, p. 115; Conchyl. Cab., p. 196, pl. 56, f. 17, 18; Monogr., ii, p. 94; iii, p. 373; iv, p. 443.—REEVE, Conch. Icon., pl. 40, f. 249.—HIDALGO, J. de C., 1870, p. 50.—*Bulinus (Gonyostomus) fusiformis* PRANG, CLESSIN, Malac. Blätter, 1888, p. 168. Not *Odontostomus fusiformis* Menke, 1828.—*Bulinus dubiosus* JAY, Catalogue, edit. 3, p. 122, pl. 7, f. 6 (1839).

Much more slender than its allies. Rang's type measured  $40\frac{1}{2}$  mill. long, 12 wide. Sr. Paz obtained this species, with many other shells from northern and interior Brazil, at Rio Janeiro; but acceptable evidence of its occurrence there is wanting. He was probably misled as to the locality by whoever supplied him with the shells. It is probably a species of the interior region.

*O. auriscervina* (Férussac). Pl. 9, fig. 3.

Shell similar to the large form of *O. angulatus* but having the lips sinuous, forming a distinct "spout," much as in *O. fusiformis*. Distantly striped.

Brazil: (Mawe); *probably Prov. Minas Geraes*.

MAWE, Travels in the Interior of Brazil, particularly in the Gold and Diamond Districts, etc., third plate, f. 4 (1812).—*Helix (Cochlogena) auriscervina* Férussac, Tabl. Syst., p. 57, no. 440 (undescribed; based upon Mawe's figure).

This is probably a form of *O. angulatus*, and resembles Reeve's figure of that species. The name is earlier than *angulatus*; but in the final arrangement both names will doubtless stand, either as species or sub-species. It is known to me solely by the original figure, copied on my plate.

*O. angulatus* (Wagner). Pl. 9, fig. 8 (typical) 4-7 (var.).

Shell oblong-conic, solid, with delicate longitudinal striae, at the sutures subrugose. Whorls 9, slightly convex, the last shorter than the spire. Spire conic, the apex a little obtuse. Aperture triangular, dilated above, compressed below, narrowed; margin expanded,



reflexed; umbilical chink deeply cut. Color greenish-white, the aperture white, surrounded within the reflexed lip with a brown band; apex of the spire brown-black. Length 1 inch, 2 lines, width  $4\frac{1}{2}$  lines [= 29x9 mill.], (*Wagner*).

Brazil: Woods on the *Solimoes and Purus rivers*, in Amazonas Province (Spix). *Piquete*, prov. Sao Paulo (von Ihering).

*Bulimus angulatus* WAGNER, Test. Bras. p. 14 (1827).—*Stenostoma puru* SPIX, on pl. 13, f. 3 of same work.—*B. angulatus* DESHAYES in Lam. An. s. Vert., viii, p. 249.—PER., Conchyl. Cab. p. 195, pl. 56, f. 15, 16; Monogr. ii, p. 94; iii, 373; iv, 443; vi, 98.—REEVE, Conch. Icon., pl. 40, f. 248.—*Pelekocheilus puru* BECK, Index Moll., p. 54 (1837).

Less slender and elongated than the allied *O. fusiformis*. The original description is given above, and the original figure copied on my pl. 9, fig. 8. From these it will be seen that the type was a narrow, straightly turreted shell. The specimen figured by Pfeiffer (pl. 9, figs. 6, 7) is somewhat less slender and larger, the figure measuring, length 49, diam. 14, length of aperture 16 mill.; and is described as whitish, ornamented with distant brown streaks; whorls 8.

A specimen from Piquete, prov. Sao Paulo (pl. 9, fig. 5) sent by Dr. H. von Ihering, is still stouter, length  $37\frac{1}{2}$ , diam. 14, length of aperture 16 mill.; outer lip regularly arcuate, not sinuous below, the columellar margin dilated, straight, columella a little sinuous, slightly prominent near the base, which is a trifle effuse and spout-like. It is distantly streaked with reddish-brown on a pale ground.

Reeve's figure of *angulatus* (pl. 9, fig. 4) shows a more robust shell than any of the preceding, with the lips sinuated to form a more distinct anterior "spout." It seems to connect *angulatus* with *auriscervina*.

Probably a number of sub-species will be defined when more specimens with exact locality data come to hand. It is apparently a widely distributed species in western and southern Brazil; the narrow typical form having been collected by Spix on the Purus and adjacent Amazon, in the low region of rubber forest, while larger, stouter shells come from the higher lands to the south. The possibility of a mistake in the locality given by Spix should be taken into consideration.

*O. FIDÆNSIS* (Moricand).

See vol. XI, p. 232. This species, described from Bahia, is probably referable to the present group rather than to *Drymaeus*.

*O. WILLI* (Dohrn). Pl. 9, figs. 9, 10.

Shell deeply rimate, fusiform, thin, glossy, spirally narrowly striate, irregularly submalleate; whitish, flamed with remote, irregular brown streaks, the apex white; *delicately and sharply striate longitudinally; suture irregularly crenulate-impressed, the impressions brown-spotted.* Whorls 8-9, a little convex, the last about two-fifths the shell's length, tapering at the base, compressed, columella folded and subangulate. Aperture oblong, the base effuse, receding; peristome simple, marked with a brown stripe within, expanded, widely reflexed at the brown-streaked columella. Length 28-32, diam. 9-9½, length of aperture 12½-14, width in the middle 6 mill. (*Dohrn*).

A variety (fig. 9) has the shell shorter, more swollen, the aperture wider and less effuse at base, the outer margin of the peristome regularly arcuate. Length 26½, diam. 9½, length of aperture 11½, width 7 mill. (*Dohrn*).

Brazil: probably in *eastern Minas Geraes*, near the Mucury River (Will).

*Bulinus willi* DOHRN, Jahrb. d. Malak. Gesellsch., x, p. 350, pl. 11, f. 5, and var. 6 (1883).

Quite similar to *B. angulatus* Wagn., but much smaller and prettier, and differing in the sculpture of the whorls and suture. Of the impressed spiral lines a few, about every sixth or eighth, are more strongly sunken than those between them, and are visible to the naked eye. The variation in form leads me to think that the difference between *B. angulatus* and *B. fusiformis* may be only individual (*Dohrn*).

It seems to be related to *O. fidaensis*.

*O. NASUTUS* (Martens). *Not figured.*

Shell rimate-perforate, fusiform, conspicuously reticulate-malleolate, finely lineolate spirally; pale corneous, streaked with brown and painted with more or less close spiral white hair-lines, the apex blackish-chestnut. Whorls 8, rather flat, regularly increasing, the first 3 smooth, lines and threads vanishing on the last whorl, which is distinctly attenuated below. Aperture three-sevenths the length

of shell, slightly oblique, narrowly oblong, without teeth; peristome narrowly expanded, white, produced in a rounded spout below and margined with brown on both sides. Columellar fold wide, white, more or less angular. Length 30, diam. 9, aperture including peristome 13 mill. long, 7 wide; exclusive of peristome  $3\frac{1}{2}$  wide (*Martens*).

Brazil: *Theophilo Ottoni*, Prov. Minas Geraes (Hollerbach).

*Bulinus nasutus* MARTENS, Sitzungs-Berichte der Gesellsch. Naturforsch. Freunde zu Berlin, Sitzung vom December 15, 1885, p. 191.

An unfigured species, probably nearer *O. willi* than to other known forms.

*O. BOUVIERI* (Dautzenberg). Pl. 9, figs. 11, 12.

Shell rather solid, a little shining, quite narrowly but deeply umbilicate. Spire conoid, the apex rather obtuse. Whorls 7, slightly convex, separated by a slightly impressed and irregularly crenulate suture, nearly smooth (but under a lens appearing delicately striated transversely and corrugate-malleate). Last whorl two-thirds the total length of shell. Aperture oblique, the margins joined by a very thin and inconspicuous callus. Angulate above, strongly produced obliquely below, and pinched in at the sides a little above the base. Columella somewhat thickened and a little reflexed, nearly straight above, then becoming very oblique and sinuous at the base. Outer lip somewhat expanded, very narrowly reflexed, a little dilated above, slightly straightened in the middle, sinuated at base. Basal margin rounded and acutely margined. Color white, rose-tinted toward the apex, ornamented with two grayish violet-brown bands on the penultimate, three on the last whorl, not extending quite to the lip. Bands showing within the throat; peristome white. Length 30, diam.  $13\frac{1}{2}$ , length of aperture 16 mill. (*Dautz*).

Color var. *albus*, entirely white (pl. 9, fig. 13).

Brazil: *Pernambuco*.

*Bulinulus (Goniostomus) Bourieri* DAUTZ., Journ. de Conchyl., xlv, 1896, p. 222, pl. 7, f. 1, 2.

Differs from the related species by its shorter form and diverse coloration.

Section *Bahiensis* Jousseaume, 1877.

*Bahiensis* JOUSS., Bull. Soc. Zool. de France, p. 311 (October, 1877).

Shell rather slender, thin, composed of 7-11 whorls, the apical ones with minute grating of vertical and spiral riblets. Aperture rounded below, the ends of the expanded or reflexed lip not separated from the whorl by grooves. Folds and lamellæ when present all simple and entering except the columellar lamella, which may be vertical. Type *O. bahiensis* Moric.

This section is closely allied to the preceding and following. It consists of two groups of species, the second of which may be subdivided.

- I. Aperture oblong, parallel-sided, the outer lip rather straightened; surface smooth, delicately striate spirally; coloration inconspicuous, corneous-whitish or brown; teeth 1 (columellar) to 4 (parietal, columellar, upper and lower palatal), with rarely a suprapalatal fold developed. Eastern Brazil.

*Group of O. bahiensis*, p. 46.

- II. Aperture oval or oblong, the outer lip arcuate; surface pitted, malleate, wrinkled or costulate. Chiefly southern Brazil.

a. No folds within the outer lip.

*Group of O. jameirensis*, p. 51.

a.<sup>1</sup> Lamellæ and folds numerous, 5-9.

*Group of O. punctatissimus*, p. 54.

*Group of O. bahiensis.*

In this group there is never more than a single lamella on the columella, and the surface of the shell is not malleated.

1. Outer lip without folds; no parietal lamella.

*bahiensis*, p. 47; *reerei*, p. 48.

2. Outer lip with upper and lower palatal folds.

a. No parietal lamella.

b. No suprapalatal fold; diam. about one-fourth the length, *occultus*, p. 48.

b.<sup>1</sup> A small suprapalatal fold; diam. nearly one-third the length, *ciaranus*, p. 49.

a.<sup>1</sup> Parietal and columellar lamellæ also present.

b. Suture thickened with a white thread, *albofilosus*, p. 50.

b.<sup>1</sup> Suture simple, *ringeis*, p. 49.

*O. bahiensis* (Moricand). Pl. 9, figs, 16, 17, 18.

Shell openly rimate-perforate, fusiform, thin, bluish or brownish-white with interrupted and ragged opaque-white streaks (sometimes wanting), and usually an interrupted brown stripe behind the lip. Surface glossy, covered with excessively fine and close spiral striae. Outlines of spire convex, the apex rather obtuse; whorls 7 to  $7\frac{1}{2}$ , hardly convex, the last tapering downward, somewhat pinched at the base. Aperture oblong, subvertical, whitish within, frequently having a broad brown stripe within the lip, interrupted at the middle of the outer margin, or reduced to two brown spots. Outer lip thin, white, well expanded. Columellar lip reflexed, a groove at its junction with the body of the shell. Columella having a moderately strong fold above, upon which is superposed a small, acute entering columellar lamella.

Length 18, diam. 6, length of aperture 8 mill.

Length  $20\frac{1}{2}$ , diam. 6, length of aperture 9 mill.

Brazil: in woods at Bahia (Blanchet).

*Helix* (*Cochlogena*) *bahiensis*, MORICAND, Mém. Soc. Genève vi, pt. 2, p. 541, pl. 1, f. 6 (1833); vii, p. 438.—*Bulinus bahiensis* DES-HAYES in Lam., An. s. Vert., viii, p. 252.—POTIEZ & MICHAUD, Galerie i, p. 134, pl. 12, f. 11, 12.—REEVE, Conch. Icon., pl. 64, f. 442.—PERE., Monogr. ii, p. 96; iii, 376; iv, 445; vi, 80.—HIDALGO, Journ. de Conchyl. 1870, p. 63.—*Odontostomus bahicola* MOERCH, Catalogus Conchyliorum Yoldi, p. 28 (1852).

The wide basal arch of the aperture is characteristic, as well as the form of the columella, which appears to bear twin folds. Many specimens are without opaque white markings, and frequently the lip stripe of brown is much reduced or wanting; and in fact Moricand's description and figure show that the type was a plain and stripeless individual.

The var. *bahicola* of Mörch (pl. 9, fig. 16) does not seem to me to have any but individual characters. It is defined as "differing from the preceding in the more slender shell with longer aperture, smaller and scarcely divided columellar fold, and gray color."

*O. bahiensis* is shown by the intermediate species *occultus* to have been derived from a four-toothed stock, like *O. ringens*; the white break in the brown lip-stripe being the vestige of a former upper palatal fold. In this case the pigment glands of the mantle have retained their former interruption after the tooth which induced it has become obsolete and lost.

*O. occultus* (Reeve). Pl. 9, fig. 19.

Shell slightly rimate, fusiform, slender, thin, smooth, pellucid, whitish. Spire long, the apex rather acute, suture impressed. Whorls  $8\frac{1}{2}$ , rather flat, the last about one-third the total length, compressed at base, streaked with chestnut around the aperture on both sides. Aperture vertical, oblong, narrow; columella provided with a triangular tooth; peristome thin, the right margin narrowly expanded, two-toothed, basal and columellar margins broadly dilated. Length 23, diam. in the middle scarcely 6 mill.; aperture with peristome 8 mill. long, 4 wide (*Pfr.*, from type).

Brazil (Cuming coll.).

*Bulimus occultus* REEVE, Conch. Icon. pl. 83, f. 617 (December 1849).—PFR. Monogr. iii, p. 368; iv, 436; vi, 76.—*Pupa reevei* DESHAYES in Fér., Histoire ii, p. 214, pl. 156, f. 18, 19 (1851).—*Odontostomus occultus* Rve., DOHRN, Jahrb. d. D. Malak. Ges., 1882, p. 104.—*Bulimus parallelus* PFR., P. Z. S., 1856, p. 389; Monogr. iv, p. 445.

Much like *O. bahiensis*, but with two folds within the outer lip. According to Dohrn these folds are variable in development, at least in the form or variety described as *B. parallelus* or *P. reevei*.

## Var. REEVEI (Deshayes). Pl. 9, figs. 20, 21.

Shell thin, pellucid yellowish-white, speckled with irregular opaque-white spots, and stained with blackish chestnut in the umbilicus and behind the lip; cylindric fusiform, narrowly compressed at the base, subumbilicate. Whorls 9, flatly convex, shallowly grooved at the sutures. Aperture squarish-oblong, three-toothed (columella bearing a subtransverse fold, two tooth-like folds rising within the outer lip, the first facing the columellar tooth, the second a little in advance); lip thin, effuse. Length 20, diam. 6 mill.

Brazil.

This form seems to me from the figures to be identical with *Bulimus parallelus* Pfr., and to differ from *occultus* Rve. in the obsolescence or small size of the lip folds.

*B. parallelus* Pfr. Shell compressed-umbilicate, fusiform, rather thin, striatulate, tawny, somewhat reticulated with a whitish epidermis. Spire long-conic, obtuse; whorls 7, moderately convex, the last a little shorter than the spire, compressed at the base. Columella lightly folded and twisted above. Aperture vertical,

oblong, with parallel sides, the base effuse, streaked on both sides with brown; peristome thin, white, expanded, the right margin impressed above the middle, columellar margin wider, with an arcuate sulcus at its junction with the whorl. Length 22, diam. 7 mill.; aperture  $10\frac{1}{2}$  mill. long,  $2\frac{1}{2}$  wide inside (*Pfr.*).

Brazil: *Santa Catarina* (Cuming Coll.).

Dohrn writes that he has four specimens from Santa Catarina which agree with Pfeiffer's description of *B. parallelus*, and are excellently represented by Deshayes' figures of *Pupa reevei*. Deshayes ascribes a columellar fold to his species, and two dentiform folds within the right margin, one opposite the columellar fold, the other a little forward. Of the Sta. Catarina shells, two have the outer lip even and thin; in the third there is a slight callous thickening in the middle, and the fourth has two tubercles, but so indistinct as to be seen only if looked for.

*O. CIARANUS* Dohrn. Pl. 8, fig. 81.

Shell subperforate, oblong-fusiform, obsoletely plicate-striate, white, somewhat glossy, rather solid. Whorls 9, but slightly convex, the earlier 6 conically widening, those below subcylindrical, the last whorl compressed at the base. Aperture subvertical, truncate-oval, 4-toothed: a compressed, sinuous obliquely descending columellar lamella, and three small marginal teeth within the lip, one basal, one in middle of the outer margin, and one at the insertion. Peristome narrowly expanded throughout, having two pits outside, the terminations distant, columellar margin dilated, half covering the perforation. Length 22, diam. 7, length of aperture 7, width 5 mill. (*Dohrn*).

Brazil: *Ceara*, state of Ceara.

*Odontostomus ciaranus* DOHRN, Jahrb. d. D. Malak. Ges. ix, 1882, p. 104, pl. 3, f. 14.

Seems to resemble *O. occultus* and *ringens* in the teeth, the lower palatal fold being sub-basal in position; but there is a suprapalatal fold near the insertion of the outer lip, and a parietal lamella is absent, as in *O. occultus*.

*O. RINGENS* (Dunker). Pl. 8, figs. 88, 89.

Shell rimate subperforate, fusiform, thin, smooth, pale corneous with brown streaks, or corneous covered with an ashen-streaked

epidermis. Spire turreted, rather acute. Whorls  $7-7\frac{1}{2}$ , nearly flat, the last scarcely exceeding one-third the length of the shell. Aperture narrow, oblong, 4-toothed: one parietal tooth, a second on the folded columella, the third at the base, and the fourth in the middle of the outer lip. Peristome white, expanded.

Length 18, diam.  $5\frac{1}{3}$ , aperture 7 mill. long, 4 wide. (Dkr.)

Brazil (Beseke); *Macahe*, prov. Rio Janeiro (Dkr. coll.).

*Bulinus ringens* DKR., Zeitschr. f. Malak. 1847, p. 83.—REEVE, Conch. Icon., pl. 75, f. 542 (1849).—PFR., Monogr. ii, p. 85; iii, 368; iv, 436; vi, 76.

A rather narrow, elongate, smooth species, with rather stout and obtuse upper and lower palatal plicæ; the parietal and columellar lamellæ compressed, the latter superposed upon a columellar fold, essentially as in *O. bahiensis*. There is a deep brown stripe behind the lip and columella, but the narrowly rounded base is white. It is related to *O. bahiensis* and especially *O. occultus*, species which differ in the absence of a parietal lamella. Dunker, if it was he who wrote the original description of *O. ringens*, gives merely the locality Brazil; but Reeve, who figures a specimen from Dunker's collection, says Macahe. The single specimen before me (fig. 89) bears no locality but "Brazil."

*O. ALBOFILOSUS* (Dohrn). Pl. 8, figs. 90, 91.

Shell rimate-perforate, fusiform, thin, rather glossy, whitish-hyaline, spirally very delicately sulcate. Spire turreted, the apex attenuated, *suture thickened with a white thread*. Whorls 7 to 8, little convex, the last about two-fifths the total length, attenuated at base, shortly ascending in front, having two pits behind the lip. Aperture vertical, oblong with an expanded peristome, broadly effuse below, milk-white and glossy; narrowed by 4 teeth: one vertical lamelli-form parietal lamella, a triangular tuberculiform columellar lamella, a large fold within the outer margin and a minute one within the basal margin. Length 22-24, diam.  $6\frac{1}{2}-7$ , length of aperture 10, width 5 mill. (Dohrn.)

Brazil: *Province of Bahia or in the Mucury River region*, in Minas Geraes (Lieut. Will).

*Bulinus albofilosus* DOHRN, Jahrb. d. D. Malak. Gesellsch. x, p. 351, p. 11, f. 7 (1883).

Nearest to *O. bahiensis* in form, but distinguished from all other



species by the thickening of the suture and the arrangement of teeth; the latter resembling those of *O. ringens*, which is apparently the most nearly allied species.

*Group of O. janeirensis.*

Aperture oval or oblong, the outer lip arcuate; a columellar fold or lamella developed, with sometimes a small basal fold and parietal lamella; no palatal folds. Surface usually rather rough, pitted, malleate, wrinkled or costulate. Species allied to *O. punctatissimus*, in which the folds or the folds and lamellæ have degenerated, leaving a toothless or almost toothless aperture. Only *janeirensis*, *miliola* and *neglectus* are known to me by specimens. The former two have typical *Drymaeus* apical sculpture, but in *neglectus* the vertical ribs predominate and are rather coarse. It may belong to *Spiria* (*q. v.*) rather than to the present group.

Possibly "*Gongostomus centiquadrus* Valenc." of Beck, Index p. 53 (Paraguay), may be something of this nature; but it is merely a name, never made good by description.

*O. RHODINOSTOMA* (Orbigny). Pl. 9, figs. 14, 15.

Shell elongate, turreted, umbilicate, a little rugose, somewhat glossy; grayish-white, with longitudinal brown lines; the *peristome and columella rose*, and with a large brown spot within the lip. Spire long, swollen for the greater part of its length, the apex obtuse; composed of 8 slightly convex whorls, the last very large, separated by a smooth suture, but little impressed. Aperture small, oval, with thin, acute peristome a little reflexed; columella wide, noticeably swollen. Length 21, diam. 7 mill. (*Orb.*).

Brazil: obtained by M. Fontaine at *Rio Janeiro*.

*Helix rhodinostoma* ORB., Mag. de Zool., 1835, p. 20.—*Bulinus rhodinostoma* ORB., Voyage, p. 317, pl. 41, f. 6-8.—PFR., Monogr. ii, p. 96; iv, 407.—*Odontostomus rhodostoma* H. & A. ADAMS, Gen. Rec. Moll. ii, p. 152.

Very close to the typical form of *O. janeirensis*, with which it may be identical.

*O. JANEIRENSIS* (Sowerby). Pl. 10, figs. 22, 23, 24.

Shell rimate, fusiform-turreted, thin but moderately strong, longitudinally streaked with opaque cream-white over ground of a pale

yellow with a median chestnut band; the opaque streaks more or less split into lines, sometimes forming a mesh or reticulation. Spire long conic with slightly convex outlines. Whorls about 8, the earlier ones roseate; last whorl tapering below. Aperture oblong, pale within, but having a large triangular brown blotch within the outer lip; peristome rose-tinted or white, broadly expanded, toothless; columella having an entering fold above, the margin dilated and reflexed. Length  $25\frac{1}{2}$ , diam.  $8-8\frac{1}{2}$ , length of aperture  $9\frac{1}{2}-10$  mill.

Brazil: *Rio Janeiro* (Sowerby, Paz).

*Bulinus janeirensis* SOWB., Conch. Illustr., *Bulinus*, p. 8, f. 97.—*Bulinus janeirensis* REEVE, Conch. Syst., ii, pl. 174, f. 97 (printed from same plate); Conch. Icon., pl. 38, f. 226 (1848).—PFR., Symbolæ ii, p. 47; Monogr. ii, p. 96; iii, 368; iv, 436; vi, 76.—HIDALGO, J. de C., 1870, p. 52.—*Helix menkeana* Fér. in Mus. Paris, according to Pfr.

Allied to *O. fusiformis*, but wanting teeth without the outer lip. Fig. 22 is a copy of the original illustration.

Var. *miliola* (Orbigny). Pl. 10, figs. 25, 26, 27, 28.

Similar to the type but often larger, with as many as 9 or  $9\frac{1}{2}$  whorls, the surface netted with creamy raised lines on a corneous ground except around the periphery, where there is usually a girdle of alternate light and dark blotches, ascending the spire above the sutures. Parietal wall usually bearing a small, acute lamella; an oblique lamella usually superposed upon the columellar fold, *which is abruptly truncate* below; basal lip often developing a small tubercle, its place marked by an external pit. Dimensions from those of *O. janeirensis* to alt.  $32\frac{1}{2}$ , diam.  $9\frac{1}{2}$ , aperture 11 mill.

*Rio Janeiro* (Fontaine); *Piquete*, prov. Sao Paulo (von Ihering, fig. 27).

*Helix (Bulinus) miliola* ORB., Voy. dans l'Amér. Mérid., Atlas des Mollusques, pl. 39, f. 1, 2 (1846).—*Bulinus fuscagula* ORB., REEVE, Conch. Icon. pl. 47, f. 305 (1848); not of Orbigny.—*Odontostomus juvenis* MOERCH, Catal. Yoldi, p. 29 (1852) based upon Orbigny's figures.

The distinction between species and variety does not seem sharply defined in some specimens; but the squarely truncate columella is the most stable differential feature of the latter. Fig. 26 is a copy of d'Orbigny's illustration. Figs. 27, 28, are from Piquete, sent by Dr. H. von Ihering.

*O. GUARANI* (Orbigny). Pl. 10, figs. 29, 30.

Shell elongate, pupoid, conspicuously umbilicate, thin, uniform gray-brown; marked with strong, conspicuous striae, especially at the suture, changing to strong ridges on the anterior part of the last whorl, and very strong within the umbilicus. Spire long, swollen, obtuse at the apex, composed of 9 very slightly convex whorls, separated by a smooth, hardly sunken suture. Aperture oblong, the peristome thin and acute; columella wide, twisted, bearing a single strong fold. Length 23, diam.  $8\frac{1}{2}$  mill. (*Orb.*).

Argentina: *Banks of the Parana* in river debris, in the provinces Corrientes and Missions.

*Helix guarani* ORB., Mag. de Zool. 1835, p. 21.—*Bulinus guarani* ORB., Voyage, p. 318, pl. 41 *bis*, f. 1.—PFR., Mon. Hel. Viv. ii, p. 206; iii, 427; iv, 487; vi, 132.—*Cyclodontina guarani* BECK, Index, p. 88.

*O. neglectus* Pfr. is apparently near this species, differing perhaps in the basal impression, which Orbigny does not mention. The apical sculpture of *guarani* is unknown to me.

*O. LONGULUS* ('Behn' Pfeiffer). *Unfigured*.

Shell imperforate, turreted-fusiform, rather thin, striatulate; whitish, marked with obsolete corneous and some reddish streaks. Spire very long, acute. Whorls 11, a little convex, the last about equal to two-sevenths the alt., attenuated at base. Aperture oblique, narrowly reversed-ear-shaped; peristome simple, unexpanded, the right margin strongly curved above. Columella with a twisted fold, alt. 30, diam.  $7\frac{1}{2}$  mill.; aperture  $9\frac{1}{2}$  mill. long, scarcely 4 wide (*Pfr.*, from type.)

Brazil: *Chicutas* (Cuming coll.).

*Bulinus longulus* Behn, PFR., Malak. Bl. vi, p. 44, 1859; Monogr. vi, p. 107.

The position in the series of this species is unknown to me, but it seems near *O. guarani*.

*O. SURGILLATUS* (Pfeiffer).

Shell narrowly umbilicated, oblong-turreted, thin, irregularly plicate-striate; corneous, marked with subpunctate opaque white streaks and some rufous ones. Spire long-conic, acute; suture very slightly crenulated. Whorls 9, convex, the last about two-fifths the total alt., subcompressed at base; columella slightly and straightly

receding. Aperture little oblique, oblong; peristome simple, the right margin unexpanded, columellar margin dilated, reflexed and overhanging above. Alt. 24, diam.  $9\frac{1}{2}$  mill.; aperture 10 mill. long,  $4\frac{1}{2}$  wide (*Pfr.*). *Bolivia* (Cuming coll.).

*Bulinus surgillatus* PFR., P. Z. S., 1856, p. 389; Monogr. iv, p. 490.

Unfigured, and known to me by the above diagnosis only.

*O. COSTATUS* (Pfeiffer). Pl. 10, figs. 36, 37.

Shell scarcely perforate, solid, cylindric-turreted, *longitudinally rather closely ribbed*, glossy, ashen flesh-colored. Spire long, obtuse. Whorls  $8\frac{1}{2}$ , rather flat, separated by an impressed suture, the last whorl scarcely one-third the total length. Columella bearing a fold-like tooth above. Aperture oblong, brown inside; peristome narrowly expanded, the right margin arcuate above, then straightened; columellar margin dilated, reflexed, nearly closing the perforation. Length 18, diam.  $5\frac{1}{2}$ , aperture 6 mill. (*Pfr.*).

Brazil (Cuming coll.).

*Bulinus costatus* PFR., P. Z. S., 1848, p. 111; Monogr. ii, p. 114; iii, 346; iv, 411; vi, 55; Conchyl. Cab., p. 160, pl. 46, f. 5, 6.—REEVE, Conch. Icon., pl. 65, f. 450 (1849).

The strong ribs, brown mouth and columellar fold, are a characteristic combination of this species.

*Group of O. punctatissimus.*

Lamellæ and folds numerous, 5 to 9; surface pitted or wrinkle-malleate.

A few South Brazilian species with many acute folds compose this group. *O. tudiculatus* and *catharinæ* are evidently very near *O. fusiformis*, and perhaps may prove to be but varieties of that snail.

By its sculpture, color pattern and occasional development of a basal fold, *O. janairensis* and some of its allies are clearly members of this group of species; but the degeneration of the folds makes it more convenient to group them apart.

*O. FUSIFORMIS* (Menke). Pl. 10, figs. 31–35.

Shell deeply rimate, oblong-fusiform, closely netted with light yellow anastomosing wrinkles upon a corneous or brownish ground, with a peripheral series of dark blotches; the surface rendered pitted

or malleate by the wrinkles; glossy. Spire long, with convex outlines. Whorls  $8\frac{1}{2}$ –9, slightly convex, separated by a white-edged suture; the last whorl strongly carinate at the base, the keel defining a flattened basal area with a median groove. Aperture oblong, white and showing the median dark band inside, slightly oblique, obstructed by 6 or 7 folds; a compressed, entering parietal lamella, a larger oblique columellar lamella, a much smaller basal fold, and three compressed folds within the outer lip, the median (upper palatal) fold largest, the others quite small; sometimes an additional suprapalatal fold being added near the upper end of the lip. Peristome rose-tinted or white, very broadly expanded.

Length 28, diam. nearly 8, length of aperture 10 mill.

Length 22, diam. 7.8, length of aperture 8 mill.

Length 24, diam.  $6\frac{1}{2}$ , length of aperture 7 mill. (Pfr.).

Length 22, diam. 6 mill. (Menke).

Brazil: *Rio Janeiro* (Dr. Varnhagen); *Province Sao Paulo* (v. Ihering).

*Scarabus fusiformis* MENKE, Syn. Meth. Moll., p. 78 (1828); edit. 2, p. 131.—*Bulinus vermiculatus* Mke. in litt., PFR., Zeitschr. f. Malak., 1849, p. 175; Conchyl. Cab. p. 260, pl. 70, f. 19, 20; Monogr. iii, p. 368; iv, 436; vi, 76.

Allied to *O. punctatissimus*, but differs in being more roughly sculptured, and wanting the fold developed between the lower palatal and basal folds in that species. It varies widely in form from subcylindric to conic, and also in size. Menke's reference of this species to the genus *Scarabus* was not unnatural for the time. His specific name *fusiformis* was subsequently changed, apparently at Pfeiffer's suggestion, on account of the *Bulinus fusiformis* described by Menke on a previous page of the *Synopsis*. This earlier *B. fusiformis* is now a *Bulinus*.

This species may be the *Odontostomus vermiculatus* of Beck, *Index Molluscorum*, p. 54; but as that is an absolutely nude name, its identity remains uncertain, and is a matter of no consequence.

Figures 32, 33 are Pfeiffer's illustrations, probably drawn from Menke's type. Fig. 31 is a specimen from Os Perus, Figs. 34, 35 from Sao Paulo, sent by Dr. von Ihering.

*O. TUDICULATUS* (Martens). *Unfigured*.

Shell rimate-perforate, fusiform, *lightly malleate-wrinkled*, brown-

streaked and variegated with white. Whorls 8, nearly flat, the last angularly compressed at the base, blackish-brown toward the aperture. Aperture oblong-ovate with 5 or 6 folds: a moderate parietal lamella, a stronger one on the columella, a third moderate basal fold, and within the outer lip a fourth fold in addition to one or two smaller ones. Peristome white, narrowly expanded. Length 24, diam.  $6\frac{1}{2}$ , length of aperture 7, width exclusive of peristome 3, inclusive  $5\frac{1}{2}$  mill. (Mart.)

Brazil: *Roedersberg* (*Sao Leopoldo*), Prov. Rio Grande do Sul (Dr. Hensel); *Taguara*, in the same region (v. Ihering); *Theresopolis*, prov. Santa Catharina (Fruhstorfer).

*Bulinus* (*Odontostomus*) *tudiculatus* MART., Malak. Blätt. xv, p. 178 (1868).—Clessin, Malak. Blätt. (n. F.), x, p. 166 (1888).—*Bulinus* (*Odontomus*) *tudiculatus* v. Mts., BOETTGER, Nachrbl. d. D. Malak. Ges., 1889, p. 30.

"Nearest allied to *B. ringens* Dkr. and *B. punctatissimus* Less. In the contour of the shell and form of the aperture, as well as in number of folds, it stands about in the middle between these two species, the narrow peristome approaching that of *ringens*, the very strong columellar fold that of *punctatissimus*, while the external sculpture differentiates it from both. Of the folds within the outer lip the strongest stands in the middle of the lip, a weaker one below it, which in the three shells before me, does not extend so far forward; and above the median fold there is a fold in two of the specimens. All three are bleached, and the ground-color therefore cannot be described; but brown streaks like those of *B. ringens* may still be seen, and also traces of a white marking crossing them, and confined to the wrinkles" (Mart.).

I have not seen this species, which from the description must be extremely near *O. fusiformis* Mke., but apparently unlike that shell in the narrow peristome, described as "*breviter expansum*."

*O. CATHARINÆ* (Pfeiffer). *Unfigured*.

Shell shortly rimate, subperforate, fusiform, rather solid, all over lightly punctate-rugulose; white, with scattered streak-like corneous dots. Spire swollen-turreted, the apex slightly acute. Whorls  $8\frac{1}{2}$ , a little convex, the last scarcely one-third the total length, having a strong compressed crest with a smaller one behind it; in front interruptedly black-streaked outside and within. Aperture oblique,

nearly 7-toothed: one parietal lamella, a subquadrangular columellar lamella, third tooth oblique and on the left side of the effuse base, and within the outer lip there are three *subequal* and one minute fold. Peristome white, moderately expanded throughout. Length 23–25, diam.  $7\frac{1}{2}$ –8 mill.; aperture with peristome  $8\frac{1}{2}$  mill, long, 5 wide (*Pfr.*). Brazil: *Santa Catharina* (Cuming coll.).

*Bulinus catharinæ* PFR., P. Z. S., 1856, p. 389; Monogr. iv, 436.

Very closely related to *O. fusiformis* Mke., as Pfeiffer remarks, and probably a variety of that South Brazilian species.

*O. PUNCTATISSIMUS* (Lesson). Pl. 10, figs. 38, 39, 40, 41.

Shell deeply rimate, fusiform, gray-white reticulated or finely marbled with opaque-white, having a wide blackish streak behind the lip, interrupted by transverse white marks. Surface very shallowly pitted, and finely striate spirally. Spire having convex outlines, rose-tinted near the summit, the apex obtuse. Whorls 8, but slightly convex; the last tapering below, pinched at the base into a short carina in the middle, grooved on the umbilical side of the carina. Aperture oblique, oblong, obstructed by 7 to 9 white teeth: a compressed parietal lamella; a large subvertical columellar lamella; two small, compressed approximate folds within the basal margin, the right one sometimes wanting and three acute folds within the outer lip, the median one (upper palatal) usually larger; frequently there is another minute fold within the lip near the suture, and sometimes a very small angular fold is developed opposite it on the parietal wall. Intervals between the folds blackish-brown. Peristome white (rarely rose), very widely expanded and reflexed, flattened.

Length 27, diam. 8, length of aperture  $10\frac{1}{2}$  mill.

Length  $26\frac{1}{2}$ , diam.  $8\frac{1}{3}$ , length of aperture 11 mill.

Brazil: *Ilha de Sta. Catharina*, prov. *Sta. Catharina* (Lesson, King); *Province of Sao Paulo*, at *Iguape* etc. (v. Ihering).

*Clausilia punctatissima* LESSON, Voy. de la Coquille, Zool. ii, pt. 1, p. 329, pl. 15, f. 3 (living animal), a, b (shell), 1830; Isis, 1833, p. 131, no. 74, pl. 2, f. 3 (copy of preceding).—*Bulinus punctatissimus* PFR., Symbolæ ii, p. 120; Monogr. ii, p. 84; iii, 367; iv, 436; vi, 75; Conchyl. Cab. p. 192, pl. 56, f. 5, 6.—REEVE, Conch. Icon. pl. 38, f. 225.—*Clausilia exesa* POT. & MICH., Galerie, i, p. 190, pl. 19, f. 17, 18 (1838).—*Helix exesa* FER., Hist., pl. 163, f. 3, 4; not

of Spix.—*Auricula fuscagula* LEA, Trans. Amer. Philos. Soc. (N. S.), v, p. 83, pl. 19, f. 76; Obs. Genus Unio i, p. 195, pl. 19, f. 76.—*Bulinus fuscagula* ORB., Voyage, p. 318 (description only, not the figures).—*Otostomus fuscagulus* BECK, Index Moll. p. 54.—*Pupa septemplex* v. Mühlfeldt, ROSSMAESLER, Iconographie der Land- und Süßwasser-Mollusken, v Heft, p. 8, pl. 23, f. 303 (1837).—*Bulinus septemplex* PFR., Symbolæ i, p. 85.—*Bulinus dentatus* KING, Zool. Journ. v, p. 340 (1830 or 1831).

*O. punctatissimus* is very closely related to *O. fusiformis*, but the basal keel is shorter and more median in position, the sculpture is less coarse, it generally has more teeth, and wants the dark girdle at the periphery, usual in *fusiformis*.

The typical form of the species (pl. 10, figs. 38, 39), from Santa Catharina island, seems to have little or no colored cuticle, being either denuded or albino; the descriptions and figures given by Lesson, King and Lea all pertaining to this form. King's description probably appeared nearly as early as Lesson's, but it is less than two lines long, and quite insufficient.

The fold on the outer lip below the lower palatal seems to be indifferently present or (as in Rossmassler's figure) wanting; though in the majority of specimens before me it exists. The angular lamella is equally variable, but its presence or absence is not always correlated with that of the lower lip-fold.

Specimens from the Province of Sao Paulo sent by Dr. von Ihering, are larger than those from Sta. Catharina, dull brown with cream-white variegation in the form of irregular and ragged streaks and lines, sometimes reticulating, or with many fine spiral hair-lines also. Fine spiral striae are conspicuous on the last whorl, though rather superficial. Whorls 8 to 9. The broad lip is bright rose colored; folds and lamellæ 8, there being no angular lamella. The early whorls are not rose-tinted, as in the typical form. Two specimens measure: Length 29, diam. 8 and 9, aperture 11 mill. The stouter one has white spiral lines, and is from Iguaçu (pl. 10, fig. 41).

#### Section CYCLODONTINA Beck, 1837.

*Cyclodontina* BECK, Index Molluscorum p. 88, in part.—PILSBRY, Nautilus xii, p. 57, type *pupoides* Spix, *inflatus* Wagn.

Species with the umbilicus noticeably excavated, aperture obstructed by numerous lamellæ and folds, the columellar lamella



twisted, the others entering; a sutural fold developed; ends of the lip separated from the whorl by grooves. Apex with minutely grated sculpture.

There are three Brazilian species, one, *O. scabrellus*, being strongly ribbed, the others merely striate.

Beck's group originally contained species of *Spixia*, *Bahiensis*, *Cyclodontina* in its present sense, and *Plagiodontes*, besides some incongruous exotic forms and several undetermined species. Hermannsen in 1846 writes "typus: *Pupa draparnaldii* Fér. vel *Pupa listeri* Gray." The former of these was a nude name, and had not been defined in 1846; the latter is probably *O. inflatus* Wagn. Under these circumstances I have thought proper to restrict *Cyclodontina* to *O. inflatus* and related forms. Fischer had no precedent for naming *O. dentatus* as the type of *Cyclodontina*, and that course is barred by the prior elimination of that species by Doering.

*O. sexdentatus* (Spix). Pl. 11, fig. 42.

A species resembling *O. scabrellus* in contour and teeth, but differing in the smooth surface. Wagner describes it as cylindric-fusiform, tapering and acute above, pellucid, very delicately striated longitudinally. Whorls 10, the last narrow below and having three deep transverse grooves behind the lip, with an impressed line below the suture. The aperture has 6 teeth: a parietal lamella, a large columellar lamella, two small folds in the base, and two within the outer margin, the lower one (upper palatal) being larger. The ends of the peristome are separated from the parietal wall by small grooves. Color whitish, with a few separated brown streaks. Length 1 inch, diam.  $3\frac{1}{2}$  lines (25 x 7 mill.).

Said to be from S. Paulo province ("in provinciis S. Pauli et Sebastianopolitana").

*Bulimus 6-dentatus* Spix, Testac. Bras., pl. 14, f. 3 (1827).—*Odontostomus sexdentatus* Spix, DOHRN, Jahrb. d. D. Malak. Ges. ix, 1882, p. 106.—? *Pupa sexdentata* WAGNER, t. c., p. 19. Not *Bulimus sexdentatus* Pfr. or Reeve.

This description agrees completely with *O. inflatus* except in the dimensions, which indicate a more slender shell. Dohrn believes that even Wagner's account does not pertain to Spix's *sexdentatus*; in which case the species must be judged by the figure alone. This is copied on my plate.

## O. INFLATUS (Wagner). Pl. 11, figs. 43-45.

Shell umbilicate, turreted-conic, corneous-white with brown longitudinal streaks, irregularly spaced, and often interrupted by a pale peripheral line. Spire straightly or convexly conic, the apex obtuse, nepionic whorls very finely decussated, the vertical lines stronger. Whorls  $8\frac{1}{2}$ -9, hardly convex, lightly striate, the last having two deep pits behind the outer and one behind the basal lip, and *a furrow below the suture* on the last third of the whorl, where it is also more strongly striate and shows fine spiral lines. Aperture short oval, obstructed by 4 to 7 teeth (or 6, if the sutural fold be not counted), the latter number typical: a compressed parietal lamella, a large *vertical* columellar lamella with a horizontal continuation below, a small, compressed basal fold, and within the outer lip four compressed folds, the median one (upper palatal) largest, the lower palatal almost basal in position, the two suprapalatal folds very small. Peristome white, broadly expanded and subreflexed, the upper margin separated from a small tubercle on the last whorl by *a distinct groove or channel in the angle*; columellar margin dilated, with a shallow groove at its insertion.

Length  $18\frac{1}{2}$ , diam.  $7\frac{1}{2}$ , length of aperture  $7\frac{1}{2}$  mill.

Length 20, diam. 8-9, length of aperture 8 mill.

Length 26, diam. 10, length of aperture 10 mill.

Brazil: *the middle eastern provinces* (Spix); *Bahia* (Blanchet, v. Ihering). Paraguay: *Barranca de la Novia*, under old wood (Bohls).

*Pupa inflata* WAGNER, Testac. Bras. p. 20 (1827).—DESH. in Lam., An. s. Vert. viii, p. 185.—*Clausilia pupoides* SPIX, Testac. Bras., pl. 14, f. 4.—*Bulinus pupoides* PFR., Symbolæ i, p. 84; ii, p. 120; Monogr. ii, 86; iii, 369; iv, 437; vi, 76; Conchyl. Cab. p. 141, pl. 45, f. 5-8.—*Odontostomus pupoides* Spix, MARTENS, Sitzungsber. Ges. Naturforsch. Fr. Berlin, 1894, p. 164.—*Helix pupoides* MORICAND, Mém. Soc. Genève vii, p. 439.—*Cyclodontina pupoides* BECK, Index Moll., p. 88.—*Pupa fasciata* Pot. & Mich., Galerie, i, p. 165, pl. 16, f. 19, 20.—*Bulinus vitreus* SPIX, Test. Bras., pl. 8, f. 2 (young shell).—*Bulinus sexdentatus* Spix, PFR., Monographia ii, p. 85; Conchyl. Cab. p. 142, pl. 45, f. 16, 17.—REEVE, Conch. Leon. pl. 38, f. 224. Not of Spix.

*Bulinus scitilabris* PFR. Zeitschr. f. Malak., 1850, p. 112; Conchyl. Cab. p. 142, pl. 45, f. 9, 10; Monogr. iii, p. 369; iv, 437;

vi, 76.—*B. pupoides* REEVE, Conch. Icon, pl. 38, f. 231; pl. 80, f. 593.—*Pupa pupoides* DESIL. in Fér., Hist., p. 216, pl. 162, f. 21, 22.—? *Helix* (*Cochlodonta*) *listeri* FERUSSAC, Prodr., Tabl. Syst. p. 60, no. 491 (see below), and ? *Helix* (*Cochlodonta*) *brasiliensis* FERUSSAC, Prodr., Tabl. Syst., p. 60, no. 492, based upon Mawe, Travels in the interior of Brazil, third plate, fig. 6 (1812).

All gradations between four- and seven-toothed extremes occur in the series before me, showing *fasciatus* to be merely one term in a continuous series of variations. Pfeiffer's description of *B. pupoides* in the Monographia, and his figures in the Conchylien Cabinet, pertain to the four-toothed form *fasciatus*, not to the original type of Spix and Wagner, which had six teeth, and is identical with the *B. serdentatus* of Pfeiffer and Reeve, but not of Spix. In some specimens the dark stripes are almost obsolete; and this appears to have been the case with Wagner's type. Fig. 46 is a Bahia specimen received from von Ihering, intermediate between *fasciatus* and *sectilabris*, having the numerous whorls of the latter.

Form *fasciatus* (Pot. et Mich.). Pl. 11, fig. 43. Similar to the type but with only four teeth developed: parietal and columellar lamellæ, and upper and lower palatal folds; the basal and suprapalatal folds of typical *inflatus* being absent. The spire is conspicuously striped and there is a blackish smear behind the lip, showing deep brown between the folds within.

Var. *sectilabris* (Pfr.). Pl. 11, figs. 47–53. Similar to *O. inflatus* but larger, with  $9\frac{1}{2}$  to 10 whorls, the suture more crenulated, and very deeply cut on the last half whorl; umbilicus rather ample within. Teeth usually 6 or 7, arranged as in *inflatus*; grooves at the end of the outer lip and columella deep, the latter emphasized by a ridge below and callus above it.

Length  $30\frac{1}{2}$ , diam. 12, aperture 13 mill.

Length  $25-29\frac{1}{2}$ , diam. 10, aperture  $10\frac{1}{2}$  mill.

#### *Province of Bahia.*

A series of 39 specimens in the collection of the Academy shows that *sectilabris* is merely a large race of *inflatus*. There are all manner of intermediate sizes, and degrees of impression of the grooves at the lip ends and the subsutural furrow. The degree of inflation of the spire is also subject to great individual variation.

*Helix* (*Cochlodonta*) *listeri* Férussac, Prodr. p. 60, no. 491, based upon Lister, pl. 31, f. 29, is an *Odontostomus* which Pfeiffer refers to

*pupoides* (*inflata* Wagn.) as a variety. It may possibly be a large form of this species, but the figure is insufficient for identification. It has been called *Pupa listeri* by GRAY, Ann. of Philos. n. ser., ix, 412, and *Cyclodontina listeri* by BECK, Index, p. 88.

*Helix* (*Cochlodonta*) *brasiliensis* Férussac, founded upon a figure in Mawe's Travels, is very likely the small typical form of *O. inflata*; but there is no description, and the figure is not absolutely conclusive. I think a reincarnation of this phantom inadvisable and indeed unwarranted. May it rest in peace!

*O. SCABRELLUS* ('Anthony' Dohrn). Pl. 11, figs. 54, 55.

Shell compressed-umbilicate, fusiform-turreted, thin but rather strong; flesh-tinted between *strong, close white ribs as wide as their interstices*. Whorls 9-10, but slightly convex, the last having two pits behind the outer, one behind the basal lip, and frequently a slight groove below and accompanying the latter end of the suture, which is there somewhat channelled. Aperture small, obstructed by 7 teeth: a compressed parietal lamella. A strong columellar lamella, bent at a right angle below, a small compressed basal fold, and four compressed folds within the outer lip, the largest one (upper palatal) median, lower palatal rather strong, nearly basal in position, two small suprapalatal folds, the upper one defining a sutural groove which notches the termination of the lip; columellar margin dilated, distinctly grooved at its root.

Length 19-23, diam.  $7\frac{1}{3}$ , aperture  $7\frac{1}{3}$  mill.

*Brazil* (Anthony).

*B. scabrellus* Anth., DOHRN, Jahrb. d. D. Malak. Ges. ix, 1882, p. 106 (under sp. 15; no description), pl. 3, f. 9.

The relationship of this species to *O. inflatus* is seen in the grooves cutting the ends of the lip, and the tooth arrangement, but it is distinct in the strong sculpture of white riblets on a fleshy or gray ground. I can find no description of the species by Anthony, whose name *scabrellus* is known by museum labels. The specimens described above and drawn in fig. 55 were received from Anthony, and bear his autograph label.

#### Section *Odontostomus* Beck, s. str.

Large and solid, elongate shells with minutely grated apical whorls and pitted surface. Teeth various, but the parietal lamella is com-

pressed and entering, and the columellar lamella and upper palatal fold stand vertically. The lip is very broadly reflexed, and there is a dark streak behind it. The species are from Bahia province.

Teeth are said to be wholly wanting in some specimens of *O. pantagrueinus*.

*Key to species of Odontostomus s. str.*

1. Large species with irregular or mesh-wrinkled surface and convex, strongly recurved lip.
  - a. Teeth 4 or 5; suture bordered with a row of white bosses; lip white. *leucotrema*.
  - a'. Suture not so decorated; teeth serrate, rarely absent. *pantagrueinus*.
2. Smaller, with coarsely shriveled surface, and pink, flatly spreading lip. *evesus*.

*O. PANTAGRUELINUS* (Moricand). Pl. 8, figs. 82-85.

Shell rimate-perforate, fusiform, solid and strong, ashen-white with flesh-colored lines and spots, and a broad purple-black stripe behind the peristome. Surface rather dull, densely and coarsely rugose, the wrinkles low, anastomosing, forming shallow long pits; a series of such impressions often bordering the suture. Spire straightly turreted, the apex obtuse, but in adults one or two whorls are frequently self-amputated. Whorls  $8\frac{1}{2}$ , convex. Aperture vertical, ear-shaped, brownish within, obstructed by large serrate teeth: an obliquely entering, high, tongue-shaped parietal lamella, buttressed on its columellar side; an erect, long, plate-like columellar lamella; a basal or subcolumellar fold or lamella, which may be either simple and acute, or compound and serrate; an entering, compressed lower palatal fold, and a large, elongate, usually serrate upper palatal barrier, above which a few suprapalatal denticles are usually developed. Peristome white, tinted within, very broadly reflexed and recurved, the face convex.

Length 65, diam. 26, length of aperture 32 mill.

Length 68, diam. 23, length of aperture 32 mill.

Length 56, diam. 19, length of aperture 28 mill.

Brazil: *Prov. Bahia* (Blanchet).

*Scarabus labrosus* MENKE, Synopsis methodica molluscorum, p. 78 (1828); Second Edition, p. 130 (1830); description insufficient

for identification.—*Helix* (*Cochlodina*) *gargantua* FERUSSAC, Prodr., Tabl. Syst., p. 62, no. 510 (insufficient desc.).—*Helix* (*Cochlodina*) *pantagruelina* MORICAND, Mém. de la Soc. de Phys. et d'Hist. Nat. de Genève, vi, p. 542, pl. 1, f. 7 (1833); vii, p. 440, with (p. 441) var. *major dentata*, *major edentula* and *minor* (the latter = *O. leucotrema*), viii, p. 142, pl. 3, f. 5 (living animal).—*Bulinus pantagruelinus* DESH. in Lam., An. s. Vert., viii, p. 255 (1838); in Fér., Hist. p. 119, pl. 162, f. 1–4.—*B. pantagruelinus* Reeve, Conch. Icon., pl. 38, f. 230.—PFR., Monogr. ii, p. 83; iii, 367; iv, 435; vi, 75; Conchyl. Cab. p. 144, pl. 45, f. 3, 4.—HIDALGO, Journ. de Conchyl., 1870, p. 51 (reports it from Rio Janeiro, *Puz*).—DOHRN, Jahrb. 1883, p. 349.—*Clausilia pantagruellina* VILLA, Dispositio Systematica Conch. p. 25.—*Odontostomus pantagruelinus* BECK, Index, p. 54 (1837).—H. & A. ADAMS, Gen. Rec. Moll. p. 152.

Exceedingly variable in the form and number of teeth, as Moricand pointed out; even toothless adult shells occurring occasionally. The aperture is sometimes placed somewhat askew (fig. 82).

*O. LEUCOTREMA* Beck. Pl. 8, figs. 77, 78.

Shell rimate-perforate, fusiform, light brown variegated by the white wrinkles, which are low, frequently anastomosing, and cut by microscopic spiral striae; the suture bordered by a row of low white nodules; a purple-black streak behind the lips. Whorls 8. Aperture oblong ear-shaped, black-bordered within, obstructed by four or five white teeth: a small entering parietal lamella, a squarish columellar lamella, and within the outer lip a compressed lower palatal, and squarish obliquely-transverse upper palatal fold, sometimes a small fold between them. Peristome snow-white, broadly reflexed and recurved.

Length 49, diam. 17–19, length of aperture 24–25 mill.

Length 45 mill. (Moric.).

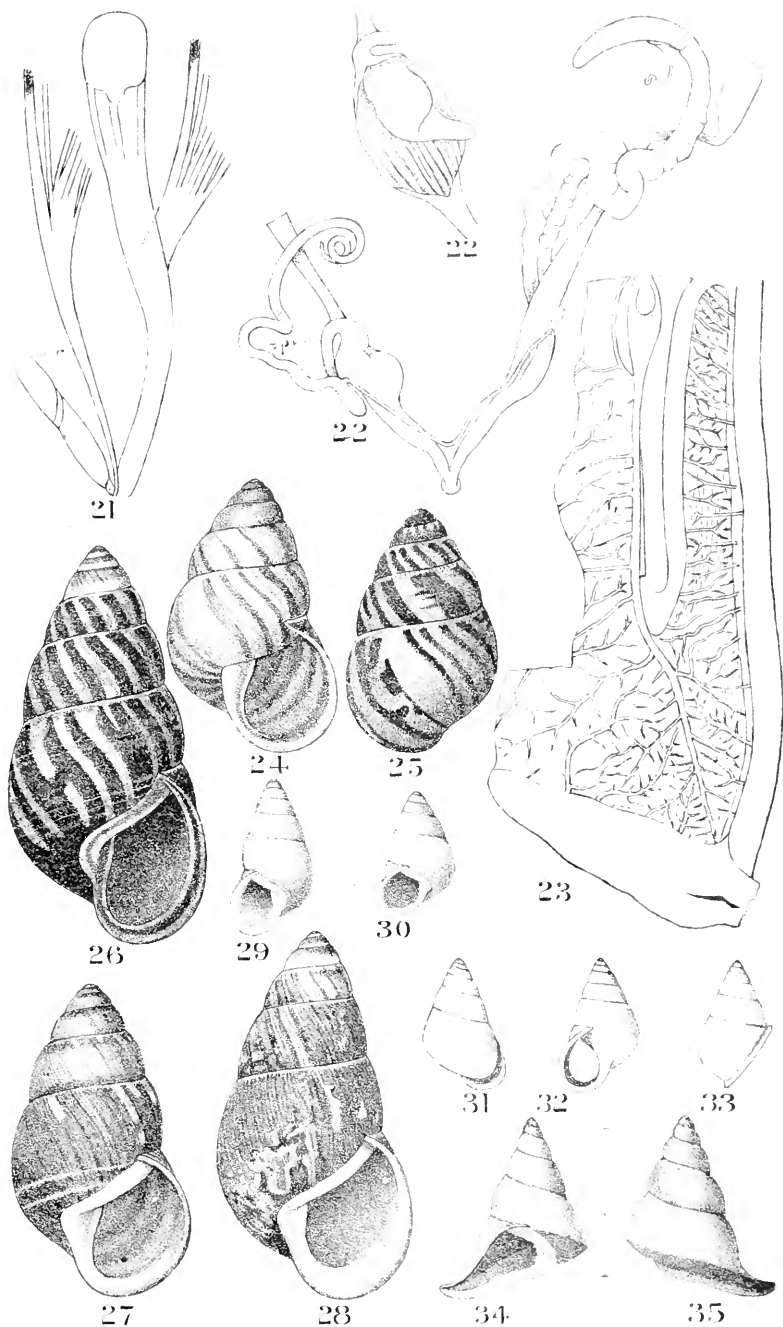
Brazil: Prov. Bahia (Blanchet).

*Pupa ringens* JAY, Catalogue of Rec. Shells, edit. 2, p. [81], pl. 1, f. 1 (1836). Not *P. ringens* Michaud, 1831.—*Helix pantagruelina* var. *minor* MORIC., Mém. Genève vii, p. 441 (1836).—*Odontostomus leucotrema* BECK, Index Moll. p. 54 (based upon the preceding).—*Bulinus pantagruelinus* var.  $\beta$  PFR. Monogr. ii, p. 83.—DESH. in Fér. Hist. pl. 162, f. 5, 6.—*B. leucotrema* PFR., Zeitschr. f. Malak. 1850, p. 109; Conchyl. Cat., *Bul.* p. 145, pl. 45, f. 11–13; Monogr. iii, p. 367.

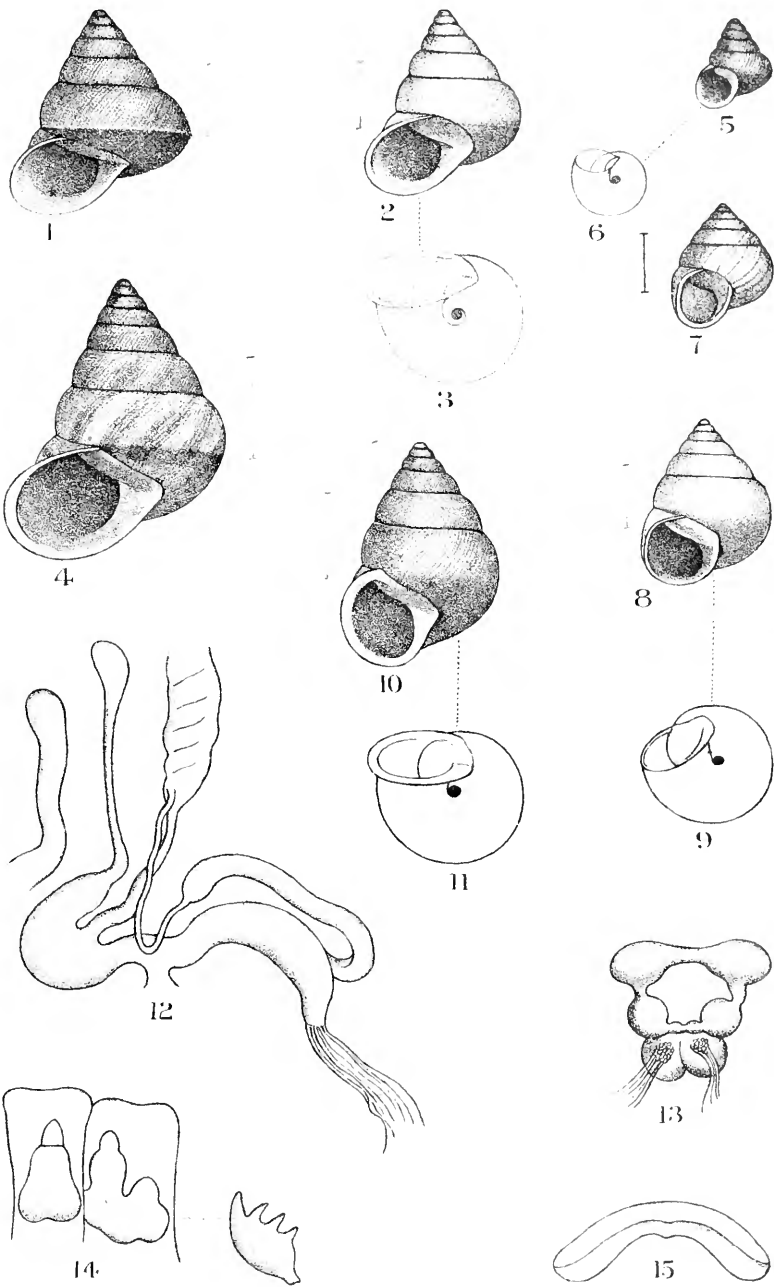




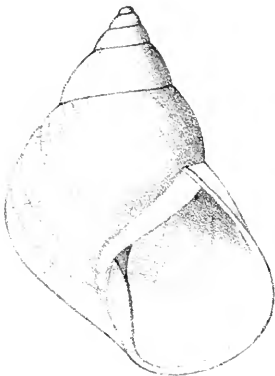




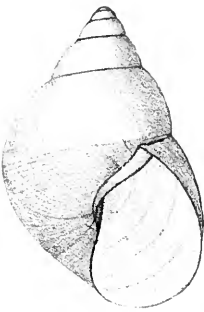








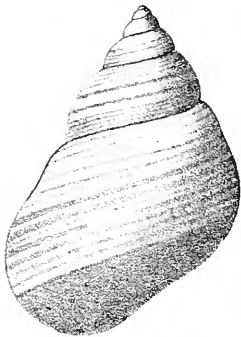
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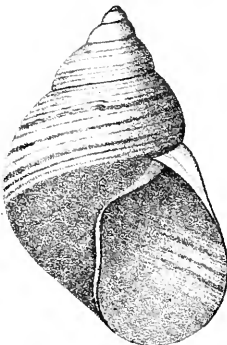
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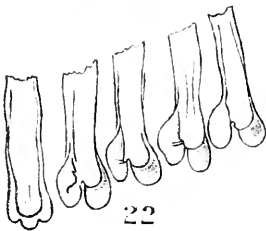
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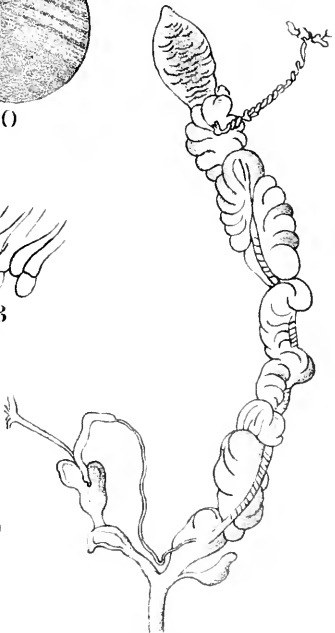
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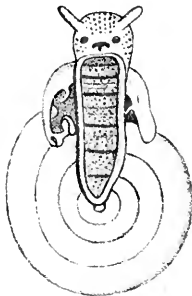


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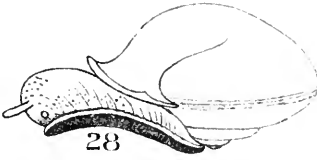


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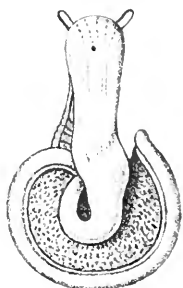




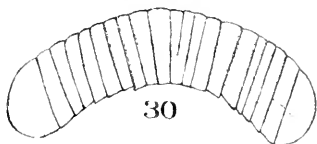
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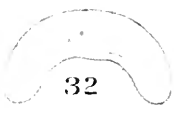
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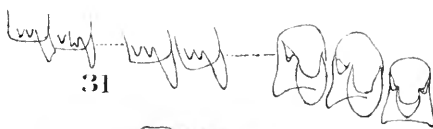
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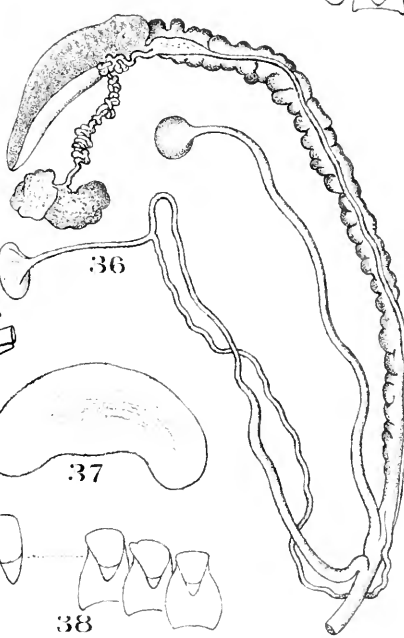
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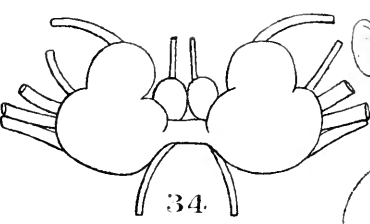
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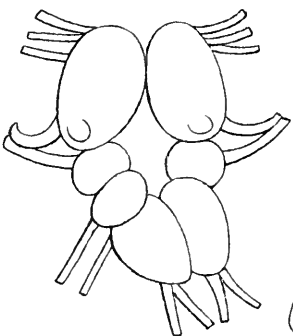
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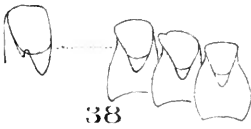
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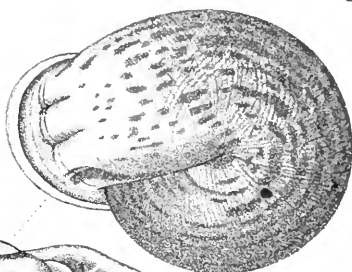
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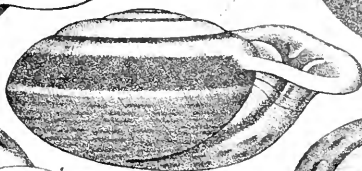




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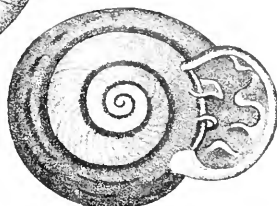
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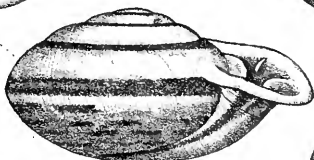
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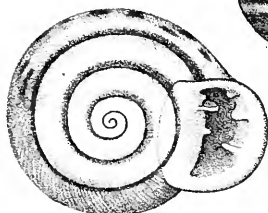
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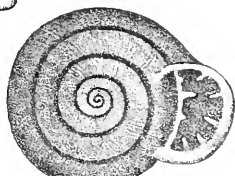
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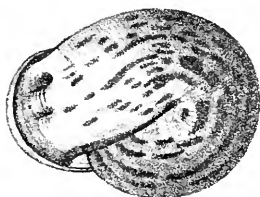
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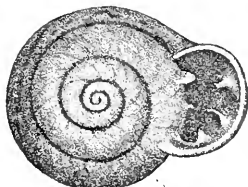
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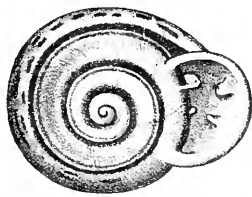
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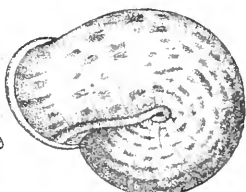
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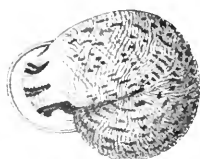




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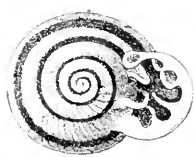
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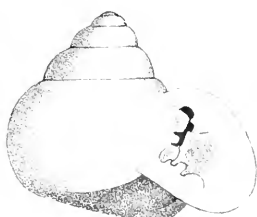
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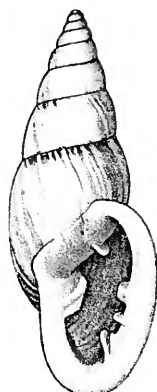


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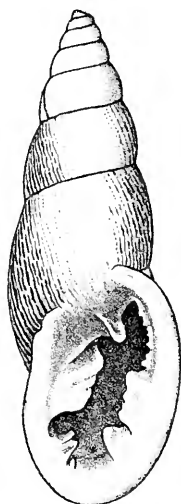
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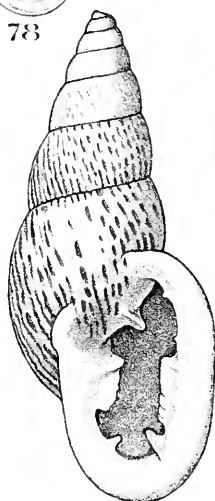
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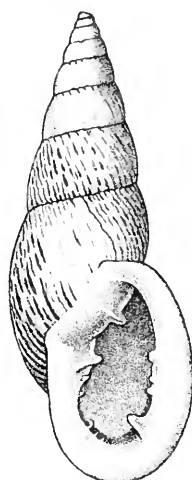
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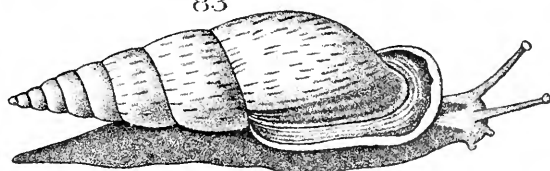
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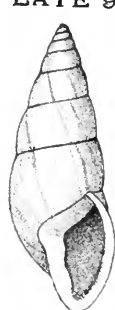
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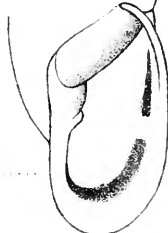
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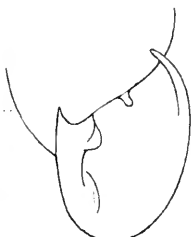
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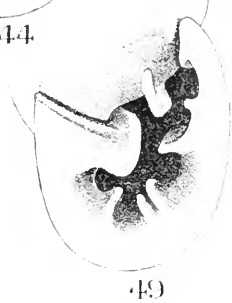
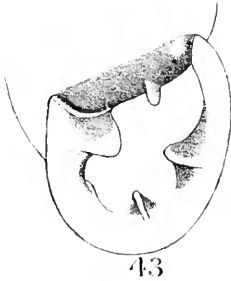


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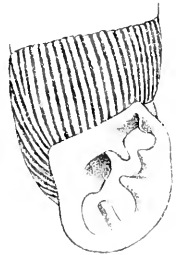
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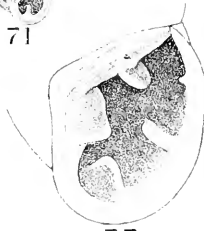
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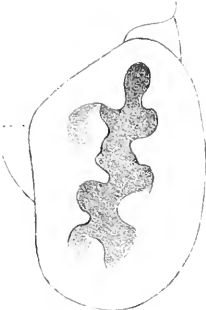


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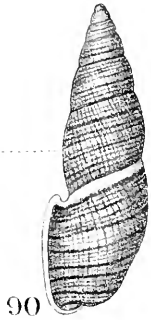
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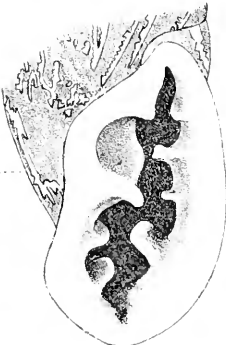
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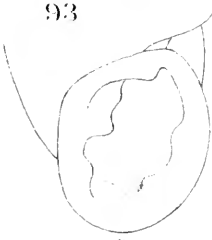
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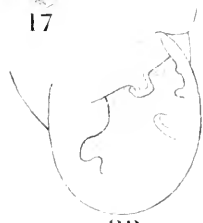
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Smaller than *O. pantagruelinus*, often more distinctly striated spirally, having the teeth less developed, and with low white bosses strung along the suture. It sometimes attains a length of 55 mill.; and while usually dark colored and less solid than the larger species, it is sometimes quite as pale and equally as strong. This form was recognized as distinct by both Moricand and Jay, prior to Beck's publication, but the Swiss and American authors used names pre-occupied in the genera to which they referred the species; hence Beck's name *leucotremata*, "white-mouth," prevails.

*O. exesus* (Spix). Pl. 8, figs. 79, 80.

Shell rimate-perforate, fusiform, solid and strong, coarsely plicate above, wrinkled and pitted below, the raised sculpture dirty white, sunken portions fleshy or ashen-gray; densely and minutely striate spirally. Whorls 8, convex, the last constricted and more or less pitted behind the lip, pinched at the base. Aperture subvertical, oblong, more or less distinctly pink, the intervals between the teeth usually dark; obstructed by four large teeth: a thin entering parietal lamella, a squarish columellar lamella, and two folds within the outer lip, the lower palatal compressed and entering, the upper palatal squarish and obliquely transverse. Peristome very broadly expanded and reflexed, especially at the lower outer portion; pink, usually with dark shading around the teeth.

Length 58, diam. 13, length of aperture  $17\frac{1}{2}$  mill.

Length 34, diam.  $13\frac{1}{2}$ , length of aperture  $16\frac{1}{2}$  mill.

Brazil: Province of Bahia (Blanchet).

*Clausilia exesa* SPIX, Test. Bras., pl. 14, f. 1 (1827).—DESHAYES, An. s. Vert., viii, p. 215 (1838).—*Pupa exesa* WAGNER in Spix, Test. Bras., p. 19.—*Helix* (*Cochlodina*) *exesa* (?) RANG, Ann. des Sci. Nat., xxiv, 1831, p. 62.—MORICAND, Mém. Genève, vii, p. 441; ix, p. 61, pl. 4, f. 8, 9 (var. *zonata*).—*Odontostomus exesus* BECK, Index Moll., p. 54.—*Bulimus exesus* PFR., Symbolæ, ii, p. 114; Conchyl. Cab., p. 291, pl. 56, f. 3, 4; Monogr., ii, p. 83; iii, 367; iv, 435; vi, 75.—DESH., Histoire, p. 120, pl. 162, f. 7–10.—REEVE, Conch. Icon., pl. 38, f. 227.—HIDALGO, Journ. de Conchyl., 1870, p. 51.

The coarsely-shriveled surface, pink lip, more or less stained with purple-black, which runs out between the teeth, or is confined to their bases, are characteristic. There is a wide range of variation in

the color-tone of both aperture and surface; and Moricand has figured a specimen having a brown peripheral band, under the name var. *zonata* (fig. 80). The pits behind the lip vary from deep to slight depressions. Four of the specimens before me show a very small denticle upon the parietal wall close to the groove at the root of the columella. The lip generally spreads flatly, but sometimes is recurved at the edge.

Rang obtained specimens said to be from Cantagallo, and Paz reports it from Rio Janeiro, but neither apparently collected the species, so that its presence in Rio Janeiro Province requires confirmation. I doubt it.

Subgenus SCALARINELLA 'Doering' Dohrn, 1874.

*Scalarinella* Doering MS. in DOHRN, Malak. Blatt., xxii, p. 202, 1874, for *S. stelzneri* Doer., = *cordovanus* Pfr.—*Clessinia* DOERING, Bol. Acad. Nac. Ciencias, p. 332, and Periodico Zoologico, i, pt. 3, p. 201 (1875), for *C. stelzneri* Doer.

Shell fusiform-turreted, slender, costulate, composed of 9 or 10 whorls, the last carinate above and below, free in front. Aperture oval, with *lamelliform* parietal and columellar lamellæ, and compressed upper and lower palatal folds and a suprapalatal fold. *Peristome continuous*, expanded, *free*. Jaw with 15 plaits.

An Argentine group, differing from *Macrodonates* by the plaited jaw, numerous whorls and lamellar parietal tooth. The apical sculpture is unknown to me, but the other known characters of the shell lead me to believe that its genesis is traceable to *Spiria*, and that it has no affinity to *Macrodonates*. It is a specialized form of the group of *O. charpentieri*.

*O. cordovanus* (Pfeiffer). Pl. 13, fig. 100.

Shell subrimate, fusiform-turreted, rather solid, densely arenate-costulate, the riblets somewhat decussated, shortly hairy; pale brown corneous. Spire long, the apex obtuse. Whorls 10, the upper ones convex, those following perceptibly flatter, the last becoming free in front, descending, acutely carinate above, the base crested and pitted. Aperture entire, oval, five-toothed: two lamelliform teeth on the left, three unequal ones within the right margin. *Peristome continuous*, expanded, whitish. Length 23, diam. 5, aperture with peristome  $6\frac{1}{2}$  mill. long,  $4\frac{2}{3}$  wide (*Pfr.*).

Argentina: near *Cordoba* (Dr. Stelzner); western slope of the *Sierra de Aconjigasta*, in moist places, la Mermela, de Jatan, del Nieve, and further south around the Aqua de los Oscuros, under rotten logs in the thorny thickets (Doering).

*Bulimus cordoratus* PFR., Malak. Blätt., ii, 1855, p. 149; P. Z. S., 1856, p. 34; Novit. Conch., i, p. 70, pl. 20, f. 1, 2; Monogr., iv, 435; vi, 75; viii, 105.—DOHRN, Malak. Blätt., xxii, p. 202 (1874), with synonym *Scalarinella stelzneri* Doering; article reprinted in Mal. Bl., xxiv, 1877, p. 157. Cf. KOBELT, Jahrb. d. D. Malak. Ges., v, 1878, p. 150, and v. MARTENS, Biol. Centr. Amer., Moll., p. 251.—*Macrodontes cordoratus* and var. *stelzneri* DOERING, Periodico Zool., ii, p. 250 (1877).—*Clessinia stelzneri* DOER., Periodico Zoologico, i, pt. 3, p. 201 (1875).

I have not seen this species.

Var. *stelzneri* Doering. Shell smaller, the whorls more convex, striae finer, the aperture subrotund. Length 16–18, width  $4\frac{1}{2}$ , aperture with peristome  $4\frac{1}{2}$  mill. long,  $3\frac{1}{2}$  wide (Doer.)

Sierra de Aconjigasta at *Jatan* (Serrazuela; Province of Cordova).

Subgenus *SPIXIA* Pilsbry and Vanatta, 1898.

*Spixia* P. & V., Nautilus xii, p. 57 (September, 1898), type *O. spixii* Orb.

Shell usually turreted with a long spire, the initial two whorls *vertically costulate*. Aperture obstructed by five teeth: a compressed parietal lamella, an oblique but usually not contorted columellar lamella, compressed upper and lower palatal folds, the latter basal in position, and a small suprapalatal. Of these the suprapalatal and lower palatal may be obsolete or wanting.

This is chiefly an Argentine group, but a few species extend into southern Brazil. I include *O. neglectus* and *lemoinei* with hesitation; the former has spiral striae between the vertical riblets on the apex, and forms a transition to the group of *O. jamaicensis*. In one species provisionally grouped here, the teeth are wanting (p. 91).

#### *Group of O. spixi.*

Rather large, solid, turreted species, chiefly of Bolivia, Brazil, and northern Argentina.

*O. SPIXI* (Orbigny). Pl. 12, figs. 60–63.

Shell narrowly umbilicate, turreted, brown or corneous-gray with

ragged opaque-white stripes; somewhat glossy, closely striate, the striae often weak or subobsolete on the last whorl or two. Spire high-conic with straight outlines, gradually and regularly tapering from the last whorl to the obtuse apex. Whorls  $10\frac{1}{2}$ – $11\frac{1}{2}$ , slightly convex, the last having a slight dent behind the outer and a deeper groove behind the basal lip. Aperture small, ovate or subpentagonal, white within, obstructed by four teeth: a compressed parietal lamella, an oblique, strong columellar lamella, a compressed lower palatal fold, basal in position, and a larger upper palatal fold in the middle of the outer lip. Peristome slightly or moderately expanded, the columellar margin dilated.

Length  $30\frac{1}{2}$ , diam. 10 mill. (Spix's figure, the type of *striatus* Spix and *spixii* Orb.).

Length 31, diam. 10, length of aperture 9 mill.

Length  $31\frac{1}{2}$ , diam. 9, length of aperture 9 mill.

Length 31, diam. 9, length of aperture inside 8 mill. (Pfr. for *B. wagneri*).

Length 32, diam. 10 (original description upon which *wagneri* was based).

Brazil: *Prov. Sao Paulo* (Spix). Varieties in Southwestern Brazil, Bolivia, Paraguay and Argentina.

*Pupa striata* WAGNER, Testae. Bras., p. 19.—*Clausilia striata* SPIX, pl. 14, f. 2 (1827).—DESH. in Lam., An. s. Vert. viii, 186.—*Cyclodontina striata* BECK, Index, p. 88.—*Bulimus striatus* PFR., Monogr. iv, p. 437; vi, 76.—*Odontostomus striatus* Spix, von MARTENS, Sitzungs-Berichte Gesellsch. Naturforschender Freunde zu Berlin, no. 7, July, 1894, p. 163–169; with var. *bohlsi*, *paraguayanus*, *spixi*, *wagneri*, p. 166.—PARAVICINI, Boll. Mus. Zool. ed Anat. Comp. Torino, ix, no. 181, p. 5.—*Helix spixii* FÉR., ORB. Mag. de Zool. 1835, p. 21, stated to be *Closilia striata* Spix; no description; with var. *major* and *minor*, undescribed; Voy. dans l'Amér. Mérid. pl. 41 bis. f. 11.—*Pupa spixii* ORB., Voy. p. 320, with var. *major* and *minor*.—*Bulimus spixii* GRAY, Figs. Moll. Anim., pl. 302, f. 7 (copy from Orbigny).—*Pupa turrita* ANTON, Verzeichniss der Conchylien welche sich in der Sammlung von Hermann Eduard Anton befinden, p. 47, no. 1748 (1839).—*Pupa conspersa* POT. & MICH., Galerie i, p. 160, pl. 16. f. 3, 4 (1838).—*Bulimus wagneri* PER., Symbolæ ad Hist. Hel., ii, p. 124 (1842), name based upon *Pupa striata* Wagn., Desh. in Lam.; Monogr. ii, p. 85; iii, 369; iv,



437; vi, 76; viii, 609; Conchyl. Cab. p. 140, pl. 45, f. 1, 2.—REEVE, Conch. Icon. pl. 38, f. 232.—*Odontostomus wagneri* Pfr. var. *paraguayana* ANCEY, Journal of Conchology vii, p. 93 (July, 1892).

This slender, turreted, gradually-tapering species is apparently rather widely distributed in the interior of S. Paulo, Paraguay, Bolivia and Argentina. Pfeiffer attempted to distinguish his *B. wagneri* from Spix's species, but there is no such distinction as he indicates to be drawn in the series of specimens before me. The earliest name for this species is *Pupa striata* Wagner, pre-occupied in *Pupa*. This precedes the name *Clausilia striata* Spix, in the same volume. The next name is *Helix spixii* of Orbigny, based solely upon *Cl. striata* Spix, in the original publication of 1835. Subsequent information shows that the renowned South American explorer had two varietal forms before him, to both of which he applied varietal names at the time he proposed the name *spixii*, defining them afterwards.

Pfeiffer originally proposed the name *B. wagneri* for *Pupa striata* Wagner, without description, but referring to Deshayes' description (An. s. Vert. viii, 186), which applies to a practically typical specimen 32 mill. long, 10 wide. He afterwards attempted to define *wagneri* as distinct from *striata*.

Von Martens (1894) proposes to admit four varieties: (*a*) *bohlsi*, (*b*) *paraguayanus*, (*c*) *spixi*, and (*d*) *wagneri*. I have already shown that the latter two names were originally applied to typical *striatus* Spix, and are not available for varieties. It is somewhat remarkable that in some localities two or more of the varietal forms occur, apparently without intergradation. Thus, in the specimens taken by Dr. Bohls at Barranca de la Novia, Uruguay, von Martens recognizes the above four forms, all sent as from the one locality, but both adult and most of the young specimens separable at a glance into the four groups. It is quite likely, however, that they were collected in different places, perhaps a few miles apart, in the course of naturalizing excursions in the vicinity of the town, and the difference may be thus explicable as the immediate reaction of varying local conditions of moisture and food. The specimens show no noticeable variation in sculpture, which consists of weak vertical striæ, becoming stronger on the middle whorls than on those above and below. There is some variation in the teeth, which, however, is not correlated with form and size variation. Thus a few specimens show a small suprapalatal fold [such as occurs in var. *minor* Orb.]. This is seen in 2 out of 6

examples of form (*b*), in 1 of 2 specimens of form (*c*), but in none of the 9 mature shells of form (*d*). A suprapalatal fold thus occurs only in the relatively stout forms, and here only in the minority of the specimens. Similarly there is a weak, narrow fold inward from and near the upper palatal fold, in 2 of the 9 specimens of form (*d*), but in no others. The same fold occurs in one of four specimens similar to form (*c*), collected at Corumbá by Rhode, and in another shell from unknown locality [also in several examined by H. A. P.]. The lower palatal fold is present in all the specimens taken by Dr Bohls.

Typical *SPIXI* Orb. Pl. 12, figs. 60 (type), 61, 62, 63.

This is the comparatively small and slender form, with four teeth, described above. In my opinion the supposed species *striatus* Spix and Wagner (fig. 60), *spixii* Orb., *turrita* Anton, *conspersa* P. & M., and *wagneri* Pfr. (figs. 62, 63), are completely identical. The Paragnay form defined by von Martens as var. “(*c*) *spixi* Orb., shorter [than *bohlsi*] but rather stout, 33 mill. long,  $10\frac{1}{2}$  wide, with 10– $10\frac{1}{2}$  whorls” belongs here “as well as specimens collected by Rhode at Corumba in Matto Grosso.” Also var. “(*d*) *wagneri* Pfr.; short and narrow, 26–31 mm. long, and only 9 wide,  $10\frac{1}{2}$ – $11\frac{1}{2}$  whorls.” One specimen of var. (*c*) has a suprapalatal fold, like the much more slender var. *minor* Orb.

Var. *BOHLSI* v. Mart.

“The longest specimens, 48–50 mill. long and only 12 or 13 wide, the measurement taken to include the outer lip, as usual, thus very slender; the aperture 12 mill. long, and including the columellar margin, 9 wide. Whorls 13–14, with weak vertical striae. Color whitish-gray, with broader or narrower zigzag streaks of rather light brown.” All the specimens have 4 teeth. Barranca de la Novia, Paragnay.

Var. *MAJOR* Orbigny. Pl. 12, fig. 66.

D’Orbigny, whose great name is due not less to his mastery of detail than to the vast extent of his works, writes that he found two quite distinct local varieties of *spixi*. One which he calls var. *major* is always large, almost smooth, or at most marked with quite distinct striae, and invariably has only four teeth; it is moreover

always more swollen. Length 35, diam. 12 mill. This form he found in the country inhabited by the Guarayos, in the heart of the humid forests of the northern frontier of the province of Chiquitos (now prov. Santa Cruz), Bolivia, and in the province of Corrientes, Argentina, in a wood near the Santa Lucia river, at a place called *Pasto reito*.

Paravicini reports this variety from the Rio Apa (Risso colony), Argentina, collected by Dr. Borelli.

I suppose d'Orbigny's figure of a living specimen to be drawn from this variety.

Perhaps the form collected by Bohls at Barranca de la Novia, Paraguay, and referred by von Martens to var. "*(b) paraguayanus* Ancy," is referable rather to *major* Orb. It is described as "somewhat shorter (than var. *bohlsi*) and comparatively wider, 41–41½ mill. long, 11½–12½ wide, with 12 to 12½ whorls; corresponding pretty well with *O. wagneri* var. *paraguayana* Ancy." Two specimens out of 6 have a suprapalatal fold. It differs from Ancy's variety in the presence of a lower palatal fold in all the specimens examined, while the absence of this fold is the chief distinguishing character of the Corumbá race. The mere dimensions of Corumbá *paraguayanus* are inconstant, one of the specimens before me having exactly the measurement of Orbigny's var. *major*.

Var. MINOR Orbigny. Pl. 12, figs. 64, 65.

D'Orbigny's other variety, *minor*, is smaller, much elongated, strongly striate, *always has five teeth* of which three are on the outer lip. Length 30, diam. 7 mill. This variety he found between Santo Corazon and San Juan, in the province of Chiquitos (now in the southeastern part of prov. Santa Cruz), Bolivia, on wooded ridges. Subsequent collectors do not seem to have encountered this form, which seems to differ from true *spixii* not only in having an additional fold (the suprapalatal), but also in being narrower.

The figures given by Deshayes apparently represent this variety. I have copied them on pl. 12, f. 64, 65.

Var. PARAGUAYANUS (Ancy). Pl. 12, fig. 67; pl. 15, fig. 34.

Larger and especially wider than *spixii*, the striation very distinct on the median whorls, fainter above and below; brown and white color pattern distinct; whorls 11–11½. *Aperture with three teeth*, the

lower palatal fold being reduced to a slight prominence or entirely wanting.

Length 40, diam. 12, length of aperture 11 mill. (typical dimensions).

Length  $38\frac{1}{2}$ , diam. 13, length of aperture 12 mill.

Length 35, diam 12, length of aperture  $10\frac{1}{2}$  mill.

Brazil: Matto Grosso at *Corumbá*, under loose limestone (H. H. Smith).

Close to var. *major* Orb., from which it differs in lacking a lower palatal fold. The locality is near that of var. *minor* Orb. It varies a good deal in size and comparative width, as the above measurements of *Corumbá* specimens indicate.

*O. HILAIRII* ('Gray' Pfeiffer.).

Shell perforate, ovate-acuminate, solid, smooth; white, with a single rufous band; spire conic, acute; whorls  $7\frac{1}{2}$ , a little convex, strongly plicate longitudinally below the suture, the last whorl about two-fifths the total length, ventricose, with compressed base. Aperture obliquely oblong, showing teeth; peristome roseate, broadly expanded, thickened, reflexed, the margins joined by a callus; a lamella on the parietal wall, another upon the columella, a smaller tooth at the base, and a larger flat-topped one within the right margin. Length 30, diam. 13, length of aperture inside 10, width 5 mill. (*Pfr.*). *Brazil.*

*Bulinus hilairii* Gray in coll., *PFR.*, *Zeitschr. f. Malak.*, 1845, p. 157; *Monogr.* ii., p. 84.

The arrangement of teeth in this unfigured species reminds one of *O. spirii*, but it is a shell of stouter figure, and plicate under the sutures. Known to me by the original description only.

*O. PYRIFORMIS* Pilsbry, n. n. Pl. 12, figs. 71, 72.

Shell rimate-perforate, ovate-conic, with exserted and very much attenuated spire, rather solid, gray-whitish, the apex brownish, slightly shining. Whorls 8, a little convex, the first  $2\frac{1}{2}$  smooth, those following costulate-striate, separated by a distinct linear suture, the last whorl somewhat inflated, the base compressed into a rounded carina, the outer margin pitted behind the lip. Aperture subquadrate-ovate, with five lamellae: the first compressed on the parietal wall; another arcuate lamella on the upper part of the colu-

mella; three compressed folds within the expanded outer and basal margins, the upper fold smallest. Margins joined by a thin callus. Length 20, diam.  $10\frac{1}{2}$ , length of aperture 8, width 6 mill. (Kobelt).

Argentina: *Sierra de Cordova* (Döring).

*Bulinus* (*Odontostomus*) *doeringii* KOBELT, Jahrb. d. D. Malak. Ges. ix, 1882, p. 5, pl. 1, f. 6, 6a. Not *B. (O.) doeringii* Kobelt, Jahrb. v. 1878, p. 135.

A very short, stout species, with rapidly-tapering spire, and teeth arranged as in the fusiform species.

*Group of O. charpentieri.*

Rather small, slender species, varying from finely striate to costulate or ribbed, with five (rarely six) teeth developed: parietal and columellar lamellæ, upper and lower palatal folds, the latter basal in position, and a suprapalatal fold. The jaw has 13–15 plaits.

All the known species are Argentine except *O. kuhnholtziensis* from Montevideo; and it is likely that there will be some reduction in their number when the numerous described forms are more fully known; though obviously the region is prolific in species and varieties, and doubtless many others remain to be found in the Sierras of Western Argentina.

Many of the species were described all too briefly by Doering in the *Boletín de la Academia de Ciencias de Cordova* in 1875, the diagnoses being copied by Kobelt in the *Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft* for 1876, and by Pfeiffer in the *Monographia Helicorum*, vol. viii (1877). Later in 1875 Doering gave extended descriptions of the same species in the *Periodico Zoologico* (Cordova); the latter being unquoted by the German authors. I do not have the *Boletín* for 1875, and quote references thereto from Pfeiffer and Kobelt, giving descriptions from the *Periodico Zoologico* for the same year.

A few of the species have been figured in the *Jahrbücher*, from specimens sent by Dr. Doering. In the *Periodico Zoologico*, 1877, additional species are defined, which are known only by the diagnoses in that rare journal, herein translated. Most of them remain unknown in collections outside of South America. Their similarity in teeth will make the species difficult to identify, the differences being chiefly those of color, sculpture, size and general form.

*O. KUHNHOLTZIANUS* (Crosse). Pl. 12, figs. 68, 69, 70.

Shell small for the genus, narrowly umbilicate and openly rimate, buff-white, cylindrical-fusiform, the lower three whorls of nearly equal width, those above forming a slowly-tapering cone, the apex obtuse. Whorls 9, the earlier 7 convex, the last two but slightly convex; first two whorls smoothish, the rest *closely and regularly rib-striate*, the riblets rarely dichotomose, mostly simple; the last whorl with a broad dent or excavation behind the outer lip, and a deep curved groove, sub-basal in position. Aperture small, vertical, nearly one-third the length of the shell, contracted by six teeth: one curved entering parietal lamella; a contorted, deeply-entering columellar lamella, and three folds within the outer lip, one (lower palatal) almost basal, a larger one (upper palatal) in the middle, a slightly smaller suprapalatal fold just above it. At the junction of the outer lip with the parietal margin there is a narrow sinus, defined by a fold on the lip and a callus on the parietal wall.

Length 17.5, diam. of last whorl above aperture 5.7; length of aperture 5.7 mm.

Length 17, diam. 6, aperture 5 mill. long (Crosse).

Uruguay: *Monterideo* (P. Paz; J. Arechavaletta).

*Balimus kühnholtzianus* CROSSE, Journ. de Conchyl. 1870, p. 301; 1871, p. 64, pl. 4, f. 3.—PFR., Monogr. viii, p. 106.—*Odontostomus kühnholtzianus* DOERING, Periodico Zoologico ii, pt. 4, p. 243.—*O. kühnholtzianus* PILSBRY, Proc. Acad. Nat. Sci. Phila., 1900, p. 393, pl. 12, f. 12.

Compared with *O. scabrellum* Anth., this species differs in the far finer costulation, less tapering form, absence of a basal fold, larger size of the suprapalatal fold, etc. *O. charpentieri* Grat. is a more lengthened and much less strongly costulate shell, with smaller aperture and no posterior channel or sinus.

*O. LEPTODON* (Martens).

Shell perforate, turreted-fusiform, costulate, white, marked with a few pale gray varices. Whorls 9, a little convex, the last slightly compressed at the base. Aperture occupying one-third the length of the shell, slightly oblique, ovate-elliptical, 5-toothed: one compressed and entering on the parietal wall; the second strong, compressed and obliquely descending on the columella; and three folds within the outer lip, the median one stronger, upper and lower ones

small. Peristome white, not thickened, narrowly expanded, the margins joined by a thin callus. Length  $21\frac{1}{2}$ , diam. 7, length of aperture 8, width 5 mill. (Mart.).

Argentina: *Cordoba* (Stelzner).

*Bulinus* (*Odontostomus*) *leptodon* v. MART., Jahrb. d. D. Malak. Ges. ii, 1875, p. 276.—PFR., Monogr. viii, p. 107.

Probably identical with one or other of Doering's species from the same district and described in the same year. In contour it stands between *O. jaueirensis* and *O. spicci*, according to von Martens.

*O. PHILIPPI* Doering. Pl. 12, figs. 73, 74.

Shell rimate, fusiform-cylindrical, slender, rather solid, opaque, ashen-buff, beautifully sculptured with whitish riblets a little narrower than their interstices. Spire lengthened-inretted, rather obtuse. Whorls  $10\frac{1}{2}$ , scarcely convex, slowly increasing, separated by a distinct suture, the last whorl hardly one-fourth the length of the shell, with a double crest at the base, becoming pale and with a pit toward the aperture. Aperture small, the peristome white, thickened, margins joined by a thick callus, having 5 lamellæ: the first, a compressed parietal lamella, the second horizontal, at the upper part of the columella, the third strong, obliquely entering in the basal margin, the fourth oblique and the fifth small, within the outer lip. Length 17-19, diam.  $3\frac{3}{4}$ - $4\frac{1}{4}$ , length of aperture 4, width 3 mill. (Kobelt).

Argentina: *Cruz del Eche*, near Totoral, in the Sierra de Cordova, northern part of the Province of Cordova, on granitic hills (Stelzner).

*Odontostomus philippii* DOERING, Apuntes etc., in Bol. Acad. Ciencias, Cordoba, 1875, p. 456; Periodico Zoologico i, pt. 3, pp. 174, 180 (1875).—*Bulinus* (*Odontostomus*) *philippii* Doer., Kob., Nachrbl. 1875, p. 8; Jahrb. d. D. Malak. Ges. ix, 1882, p. 6, and *Bul. philippianus* on pl. 1, f. 7, 7a.—*Bulinus philippii* PFR., Monogr. viii, p. 612.—*Bulinus* (*Odontostomus*) *doeringi* KOBELT, Jahrb. v, 1878, p. 135 (new name for *philippii* Döring 1875, not Pfr.).

\* The most beautiful of the fusiform species, sufficiently different from all others in its handsome ribbing (Kob.). The name *philippii* was not preoccupied in *Odontostomus*, so the change proposed by Kobelt in 1878 was unnecessary. He apparently forgot or repudiated the change when treating of the species in 1882.

Doering's original description is as follows: Shell fusiform-cylindrical, slender, rather solid, opaque, ashen-buff, closely whitish-costulate; spire long-turreted, rather obtuse. Whorls  $10\frac{1}{2}$ , slightly convex, the last scarcely one-fourth the total length, pale in front. Peristome white, thickened, the margins joined by a compressed callus. Length 17-19, diam.  $3\frac{3}{4}$ - $4\frac{1}{4}$ , aperture with peristome 4 mill. long,  $3\frac{1}{3}$  wide (*Doer.*).

#### O. ACONJIGASTANUS Doering.

Shell rimate, fusiform-turreted, pellucid, very closely striate; brown, variegated with close opaque-white striae, frequently with longitudinal, brown-reddish spots, sometimes interrupted. Spire turreted, the apex attenuated, rather obtuse. Whorls 12, a little convex, the first uniform corneous-brown, nearly smooth, the rest variegated, closely striate with white; last whorl nearly one-fourth the length, impressed at the side, two-crested at the base. Aperture oval quadrangular, contracted by 5 teeth; peristome white, expanded, rather acute, the margins joined by a depressed, sublamelliform parietal callus; columellar margin reflexed. Length 18-21, width 5 mill.; aperture with peristome 4 to 5 mill. long,  $3\frac{1}{2}$  wide (*Doer.*).

Argentina: *Sierra de Aconjigasta*.

*O. aconjigastanus* DOER., Periodico Zool. ii, pt. 4, p. 245 (1877).

Differs from *O. charpentieri* Grat. by the more numerous, slightly convex whorls and brown color; from *O. maculosus* Doer. by the more swollen, wider form, closer whitish striae, and subsolute peristome.

#### O. CHARPENTIERI ('Grateloup' Pfr.). Pl. 12, figs. 75, 76, 77.

Shell rimate-subperforate, fusiform-oblong, very delicately striatulate, corneous whitish, not pellucid; spire turreted, the apex somewhat obtusely attenuated. Whorls 10, scarcely convex, the last slightly exceeding one-fourth the length, with pits at the base and side behind the aperture. Aperture oblong-oval, 5-toothed: one on the parietal wall, a second horizontal lamella on the columella, the third tooth basal, fourth and fifth small, within the right margin. Peristome simple, the margins joined by a thin callus, right margin narrowly expanded, columellar margin widely reflexed.

Length 20, diam.  $5\frac{2}{3}$ , length of aperture 6, width 4 mill. (*Pfr.*).

Length 21, diam. 6 mill. (*Hidalgo*).



Argentina: *Cordoba* (Pfr.); *Cordoba de Tucuman*, under stones, in abundance (Paz); western slope of the Sierra de Cordova etc. (Doering).

*Bulinus charpentieri* Grateloup *in litt.*, Pfr., Zeitschr. f. Malak. 1850, p. 14; Conchyl. Cab. p. 143, pl. 45, f. 14, 15; Monogr. iii, p. 369; iv, 436; vi, 76; viii, 609.—HIDALGO, Moluscos del Viaje al Pacifico, p. 81; Journ. de Conchyl. 1870, p. 52.—*O. charpentieri* DOERING, Periodico Zoologico i, pt. 3, p. 188.

This species is allied to *O. kuhnholtzianus*, but it tapers more, has less pronounced sculpture, etc. Fig. 77 was drawn from a coarsely striate specimen. Two before me measure: length 17, diam.  $5\frac{1}{2}$ , aperture 5 mill., and 18,  $5\frac{1}{2}$ ,  $5\frac{1}{3}$  mill. In one of them the upper palatal and suprapalatal folds are preceded by smaller folds within their inner ends. The lower palatal fold is quite basal in position. The first  $1\frac{1}{2}$  whorls are costellate, as in the allied but much larger *O. spixii*.

Hidalgo describes a variety as more slender, corneous, very closely sculptured with somewhat oblique, stronger and very irregular opaque-white striae; aperture about one-fourth the total length; peristome less expanded, the margins generally connected by a heavier callus. Length 22, diam. 5 mill.

It is closely related to *O. maculosus*, but distinguished by the light color, slightly flatter whorls, the teeth and peristome, as well as the whole shell more solid, less slender.

#### *O. POPANUS* Doering.

Shell rimate, narrow, fusiform-turreted, subpellucid, pale brownish-buff; closely wrinkle-striate; variegated with whitish, irregular predominating striae. Spire subfusiform turriculate, the apex but little attenuated, rather obtuse. Whorls 9–10, scarcely convex, the first more convex, uniform brown-buff, delicately substriate, the following whorls variegated with close, whitish, opaque and irregular striae, last whorl scarcely one-fourth the length of the shell, somewhat compressed, whitish around the aperture, scrobiculate-impressed at the side, two-crested at base. Aperture strongly angular, obliquely subquadrangular, narrowed at the base, having 5 teeth; peristome white, acute, thickened within, the right margin angular above, columellar margin reflexed; margins joined by a thin parietal callus. Length 21–23, width  $6\frac{1}{2}$  mil.; aperture with peristome  $6\frac{1}{3}$  mill. long, 4 wide (Doer.).

Argentina: *Cerro de Popa*, Sierra de Pocho.

*O. popanus* DOER., Periodico Zool. ii, pt. 4, p. 244 (1877).

This species has the coloration of *O. charpentieri*, but differs sufficiently by its larger size, less convex whorls, etc. The differences from the following species have been indicated below. It was found on the trachytic hill of Yerba Buena.

*O. ACHALANUS* Doering.

Shell rimate, fusiform or fusiform-turreted, the apex somewhat obtuse; subpellucid, brownish-ashen, closely wrinkle-striate; ornamented with whitish, opaque, irregular striae and some irregular, longitudinal, corneous-brown spots. Spire fusiform-turreted, the apex a little attenuated, somewhat obtuse. Whorls 9 to 10, a trifle convex, the first whorl a little convex, uniform buff-brown, delicately striate, the rest sculptured with irregular, rugulose, opaque, close striae, usually rugulose-sculptured with obsolete, slightly impressed, spiral lines; last whorl from one-fourth to one-third the shell's length, a trifle convex, more or less calcareous around the aperture, serobiculate-compressed at the side, two-crested at the base. Aperture subangulate, quadrangular-ovate, contracted by 5 teeth; two lamelli-form teeth within the left margin, a third at the base, fourth and fifth smaller, within the right margin; peristome white, expanded, somewhat acute, thickened within, the right margin subangular above, columellar margin a little reflexed; margins joined by a parietal callus. Length 21-27, width 6-7 mill.; aperture with peristome 6 mill. long,  $4\frac{1}{3}$  wide (*Doer.*).

Argentina: *Sierra de Achala (Quebrada de Musi)*.

*O. achalanus* DOER., Periodico Zoologico: Organó de la Sociedad Zoológica Argentina, ii, pt. 4, p. 243 (Cordoba, 1877).

*O. martensi* is much more ventricose, with more convex whorls. *O. popanus* is more nearly related, but the present species is narrower, with less angular aperture, the base less pinched and more oval, etc.

*O. MACULOSUS* Doering.

Shell rimate, cylindric-fusiform, long-turreted, thin, closely wrinkle-striate; corneous brown, streakedly maculate with irregular, obsolete whitish striae. Spire turreted, a little obtuse. Whorls 10, a little convex, the last one-fourth the total length, slightly impressed at the side, the base obsoletely two-crested. Aperture sub-

oval, contracted by 5 teeth: one in the middle of the parietal margin, the second angular and twisted, on the columella, third within the base, the fourth and fifth small, within the right margin. Peristome white, expanded, a little acute, the margins joined by a somewhat lamelliform, compressed callus, right margin shortly subarcuate above, expanded below, columellar margin reflexed. (Doer., Per. Zool.)

Length  $16\frac{1}{2}$ , diam. 4, length of aperture 4, width  $3\frac{1}{4}$  mill.

Length  $18\frac{1}{3}$ , diam. 5, length of aperture  $4\frac{3}{4}$ , width  $3\frac{1}{2}$  mill.

Length 20, diam. 5, length of aperture  $4\frac{3}{4}$ , width  $3\frac{1}{4}$  mill.

Shell cylindric-fusiform, thin, closely rugose-striate; corneous-brown, irregularly streakedly spotted with whitish striae, spire long-turreted, a little obtuse; whorls 10, a trifle convex, the last whorl one-fourth the total length; peristome acute. Length 18-20, diam.  $4\frac{1}{2}$ -5, aperture with peristome  $4\frac{1}{2}$  mill. long,  $3\frac{1}{3}$  wide (Doer.).

Argentina: *Sierra Chica de Cordova*, in the valley of the arroyo de la Reduccion.

*O. maculosus* DOER., Bol. Acad. Cienc. Cord., p. 455 (1875); Periodico Zool. i, pt. 3, p. 186 (1875).—*B. maculosus* Doer., KOB., Nachrbl. 1876, p. 7.—PERR., Monogr. viii, p. 611.

Similar to *O. profundidens* in form, but larger, the striation less sharp, the color much darker corneous-brown or chestnut, with a few oblong, interrupted and irregularly spaced spots composed each of 2 to 5 fine striae.

#### *O. OLAINENSIS* Doering.

Shell rimate, fusiform-turreted, corneous-whitish, silky, slightly diaphanous, very minutely striate; spire obtuse; whorls 9, a little convex, the first nearly smooth, the rest closely and very minutely striate, the striae flattened; last whorl one-fourth the total length, two-crested at the base, the side depressed and deeply pitted. Aperture irregular, pentagonal, narrowed at the base, obstructed by 5 teeth: a slender, compressed one on the parietal wall, the second compressed and twisted, on the columella, third on the base; fourth twisted, and fifth usually dilated transversely, within the outer lip. Peristome nearly simple, a little acute, the margins joined by a thin callus, right margin strongly arched above, lower margin slightly expanded, the columellar margin narrowly reflexed. (Doer., Per. Zool.)

Length 12, diam.  $3\frac{2}{3}$ , length of aperture  $3\frac{1}{3}$ , width  $2\frac{1}{2}$  mill.

Length  $12\frac{1}{2}$ , diam.  $3\frac{2}{3}$ , length of aperture  $3\frac{1}{2}$ , width  $2\frac{2}{3}$  mill.

Argentina: *Pampa de Olain*, Sierra de Cordova, at 900 meters elevation (Dr. Stelzner).

*O. olainensis* DOER., Bol. Acad. Cienc. Cordova, 1875, p. 454; Periodico Zoologico i, pt. 3, p. 192 (1875).—*B. olainensis* KOBELT, Naehr. d. D. Malak. Ges. viii, 1876, p. 5.—PFR., Monogr. viii, p. 610.

A strongly characterized species, differing from all others in the more irregular aperture, uniform corneous-whitish color, a little transparent, and the very irregular teeth. The striation is very fine.

#### *O. CHAMPAQUIANUS* Doering.

Shell rimate, small, fusiform-turreted, brown-corneous, roughened by close rugulose striae, reticulate-variegated by elevated, membranaceous spiral lines. Whorls 9, a little convex; the first convex, very closely striate, those following roughened by little-elevated, membranous lamellae arranged in spiral lines; the last whorl about one-fourth the total length, scrobiculate in front, two-crested at the base. Aperture subpentagonal, nearly closed by five teeth and lamellae: a twisted lamella on the parietal wall, a bifid one on the columella, a small tooth within the base, with a fourth strong tooth and a fifth small one within the outer lip; frequently a sixth tooth projecting at the upper part of the right lip. Peristome expanded, acute, thickened within, the right lip angulated above, columellar margin a little reflexed, the margins joined by a thin callus. Length 15–16, width 4, aperture with peristome 4 mill. long, 3 wide (*Doer.*).

Argentina: widely spread on the *southwestern slope of the Sierra de Achala*; granitic hills of the eastern slope of the Sierra de Aconjigasta, around None; Quebrada del Rio de Mina Clavero, extending to the southern extreme of the Sierra de Achala, occurring at the Quebrada de Oyada, in the province of S. Luis.

*O. champaquianus* DOER., Periodico Zool., ii, pt. 4, p. 249 (1877).

This species has some resemblance to *O. profundidens*, found on the north of the S. de Achala; but it differs at first sight by the spiral lines formed of fine lamellae, very delicate, fragile and membranous, forming a reticulate sculpture. The shell is more compact and narrow, the whorls much more convex, and there are differences in the teeth.

*O. PROFUNDIDENS* Doering.

Shell rimate, cylindric-fusiform, turreted, slender, rather solid, not shining; ashy-ochraceous, often streakedly-variegated, with pellucid corneous obsolete spots; very closely longitudinally rugulose-striate, or very minutely costulate, with whitish. Spire conic-turreted, a little obtuse, the suture hair-like. Whorls 9, a trifle convex, the first buff-corneous, slightly striate, the rest very closely obliquely costulate-striate; last whorl one-fourth the total length, whitish around the aperture, pitted on the side, with a short, obsolete crest below. Aperture suboval, contracted within by five teeth: one on the parietal wall, a second arcuate and twisted tooth on the columella, third in the base, fourth and fifth small, within the outer lip. Peristome white, expanded, a little acute; the margins joined by a thin callus, right margin shortly arcuate above, expanded beneath; columellar margin more widely reflexed, callous (*Doer.*, *Per. Zool.*).

Length  $13\frac{1}{2}$ , diam.  $3\frac{1}{2}$ , length of aperture  $3\frac{2}{3}$ , width  $2\frac{2}{3}$  mill.

Length 15, diam.  $3\frac{1}{3}$ , length of aperture 4, width  $2\frac{3}{4}$  mill.

Length  $15\frac{1}{2}$ , diam.  $3\frac{1}{2}$ , length of aperture 4, width 3 mill.

Shell fusiform, cylindrical, slender, not glossy, ashen-ochre color, usually variegated in two streaks with obsolete pellucid-corneous spots; very densely rugulose-striate or most minutely costulate. Spire turreted, rather obtuse. Whorls 9, slightly convex, the last one-fourth the total length. Peristome acute. Length 15, diam.  $3\frac{2}{3}$ , aperture with peristome 4 mill. long,  $2\frac{2}{3}$ —3 wide (*Doer.*, *Boletin*).

Argentina: *Sierra de Achala*, around *San Carlos*, at 600 meters elevation, province of Cordova (*Stelzner*).

*O. profundidens* DOER., *Bol. Acad. Cienc. Cordova*, p. 455 (1875); *Periodico Zoologico*, i, pt. 3, p. 185 (1875).—*B. profundidens* Doer., *KOBELT*, *Nachrbl.*, 1876, p. 7.—*PFR.*, *Monogr.*, viii, p. 611.

This species is chiefly characterized by the rather sharpened peristome, the lip thinner at the superior angle of the aperture. These characters are, in some measure, common to the related but much larger species *O. maculosus*.

*O. TUMULORUM* Doering.

Shell cylindric-fusiform, small, rather solid, nearly smooth, slightly shining; whitish, variegated with pellucid-corneous; spire fusiform-turreted, slightly obtuse. Whorls 9, a trifle convex, the first corneous-buff, the last one-fourth the total length. Teeth of the aperture

thickened; peristome thick. Length 12-13, diam.  $3\frac{2}{3}$ -4, aperture with peristome  $3\frac{1}{2}$  mill. long,  $2\frac{2}{3}$  wide (Doer., Boletin).

Argentina: *Sierra de Cordova*, on the western slope, on the hills of Calera around the town of Cordova, etc.

*O. tumulorum* DOER., Bol. Acad. Cienc. Cord., p. 456 (1875); *Periodico Zoologico*, i, pt. 3, p. 187 (1875).—*B. tumulorum* Doer., KOB., Nachrbl., 1876, p. 7.—PFR., Monogr., viii, p. 611.

Doering's more extended description follows:

Shell rimate, cylindric-fusiform, small, the apex attenuated, obtuse, rather solid, closely and very minutely striate, nearly smooth, slightly shining; corneous-whitish, variegated with pellucid-corneous. Spire fusiform-turreted, a little obtuse. Whorls 9, a trifle convex, the first buff-corneous, nearly smooth, the rest whitish, variegated with pellucid-corneous spots, the last whorl pellucid corneous ornamented with close whitish striae, one-fourth the total length. Scrobiculate at the side and base, the latter shortly two-crested. Aperture suboval, contracted by 5 teeth: a compressed one in the middle of the parietal margin, the second horizontal, twisted, on the columella, a third within the base, the fourth, compressed, and fifth small, close together within the outer lip (Doer., Per. Zool.).

Length 12, diam.  $3\frac{1}{2}$ , length of aperture  $3\frac{1}{2}$ , width  $2\frac{3}{4}$  mill.

Length  $13\frac{1}{2}$ , diam. 4, length of aperture  $3\frac{2}{3}$ , width  $2\frac{2}{3}$  mill.

#### O. PUCURANUS Doering.

Shell rimate, cylindric-fusiform, brown-corneous or grayish-brown, slightly shining, closely, minutely striate, usually variegated with whitish, interrupted, irregular striae. Spire fusiform-turreted, the apex a little obtuse; suture deep. Whorls 9, a trifle convex, the last about one-fourth the total length, shortly two-crested at the base, scrobiculate at the side. Aperture somewhat angularly suboval, contracted by 5 teeth: one in the middle of the parietal wall, a second twisted tongue-shaped one on the columella, the third basal, fourth and fifth small, within the outer lip. Peristome white, thick, the margins joined by a compressed, lamelliform callus; right margin shortly arcuate above, narrowly expanded below, columellar margin more widely reflexed. (Doer., Per. Zool.)

Length  $12\frac{1}{2}$ , diam.  $3\frac{1}{2}$ , length of aperture  $3\frac{1}{2}$ , width  $2\frac{1}{4}$  mill.

Length 14, diam.  $3\frac{1}{2}$ , length of aperture  $3\frac{1}{2}$ , width  $2\frac{1}{4}$  mill.

Length  $14\frac{1}{2}$ , diam. 4, length of aperture  $3\frac{1}{2}$ , width  $2\frac{3}{4}$  mill.

Shell cylindric-fusiform, brown-corneous, slightly shining, minutely striate, generally somewhat variegated with whitish, interrupted, irregular striae. Spire fusiform-turreted, the apex a little obtuse; whorls 9, a trifle convex, the last one-fourth the total length. Peristome white, thick, the margins joined by a compressed callus. Length 13-14, diam.  $3\frac{1}{2}$ -4, aperture with peristome  $3\frac{1}{2}$  mill. long,  $2\frac{3}{4}$  wide (*Doer.*, Boletín, p. 456).

Argentina: *Valle del Rio Primero*, in the Sierra Chica de Cordova, under stones.

*O. pucaranus* DOER., Bol. Acad. Sci. Cord., p. 456 (1875).—*O. pucaranus* DOER., Periodico Zool. i, pt. 3, p. 183 (1875).—*B. pucaranus* DOER., KOB., Nachrbl., 1876, p. 8.—PFR., Monogr. viii, p. 612.—*B. pucaranus* KOB., Jahrb., 1878, p. 134.

Close to *O. tumulorum* in contour, but the aperture is narrower, the teeth and peristome less thick. The shell is more fragile, generally of a dark color, a little transparent, smooth and shining; more rarely there are some sparse chestnut spots.

#### O. RIOJANUS Doering.

Shell rimate-perforate, fusiform, the apex attenuated, a little obtuse; scarcely shining; ashen-whitish, with scattered dots and spots of pellucid ashen; closely rugose-striate, and ornamented with some longitudinal ashen-corneous spots. Spire conic, the apex attenuated, a little obtuse. Whorls 9, a little convex, the first corneous-brown, rib-striate the rest ashen-whitish, spotted, closely wrinkle-striate, often variegated with obsolete lines; the last whorl one-fourth to one-third the total length, nearly smooth, with scattered zigzag clear corneous markings, becoming whitish anteriorly, somewhat impressed at the side, the base obsoletely and shortly two-crested. Aperture angularly oblong-oval, obstructed by 5 teeth: one on the parietal wall, a second horizontal one on the columella, another within the base, the fourth and fifth teeth small, within the outer lip. Peristome white, somewhat thick, thickened within, the right margin arcuate above, lower and columellar margins broadly expanded, a little reflexed, the margins joined by a thickened, depressed, lamelliform parietal callus. (*Doering*, Per. Zool.)

Length  $18\frac{2}{3}$ , diam.  $5\frac{2}{3}$ , length of aperture  $5\frac{1}{4}$ , width 4 mill.

Length  $19\frac{1}{3}$ , diam. 6, length of aperture  $5\frac{1}{3}$ , width 4 mill.

Length 21, diam. 6 to  $6\frac{1}{2}$ , length of aperture  $5\frac{1}{2}$ , width  $4\frac{1}{4}$  mill.

Argentina: Sierra de Rioja, around the town of the same name (Dr. Stelzner).

*O. riojanus* DOER., Bol. Acad. Cienc. Cord., 1875, p. 454.—*O. riochanus* DOER., Periodico Zool. i, pt. 3, p. 190 (1875).—*Bulinus riojanus* PFR., Monogr. viii, p. 610.—KOBELT, Nachrbl. d. D. Malak. Ges. viii, 1876, p. 6.

The form is more swollen and the right margin of the peristome is more curved than *O. martensi* and *O. pseudosexdentatus*. The basal carinae and pits behind the outer lip are but little developed.

Doering altered the spelling of the name in his second publication of the species, but the change seems unnecessary.

*O. ALVAREZII* (Orbigny).

Shell elongate, pyramidal, distinctly umbilicate, thick, longitudinally striate; spire long, the suture deep. Aperture angular, irregular, showing 5 teeth; two on the columella, three on the outer lip, the upper one [that is, the lower palatal fold] marked outside by a depression. Peristome thin and sharp. Length 19, diam. 6 mill. (*Orb.*).

Argentina: Province of Entre-rios, at the village *Feliciano*, on the Parana river (*Orb.*).

*Helix alvarezii* ORB., Mag. de Zool. 1835, p. 22, no. 120.—*Bulinus alvarezii* ORB., Voy., p. 319.—PFR., Monogr. ii, 139.—*Odontostomus alvarezii* ORB., DOERING, Periodico Zoologico, i, pt. 3, p. 193 (1875).

It was found dead and bleached in a layer of humus containing fragments of land and river shells, over 60 meters above the present level of the Parana river. d'Orbigny supposed that the species had been killed out by the custom the colonists have of burning over the plains to renew the pasturage. It will probably be found to survive in some locality. In the original publication d'Orbigny describes it as with "dentibus septem, duobis supra columellam, duobus marginata;" some of the teeth being thus unaccounted for; but as the rest of the description agrees verbally with that in the *Voyage*, I presume that "*septem*" was written inadvertently. The species has not been figured and apparently belongs near *O. charpentieri*.

Dr. A. Doering has identified some specimens collected by Dr. Stelzner in the Sierra de Tulumba, in the northern part of the Province of Cordova, with Orbigny's species, but not without some



doubt. As his description is not accompanied by a figure, and probably pertains to an allied but not identical species, I do not think it necessary to reproduce it in this place.

*O. subsexdentatus* Doering.

Shell profoundly rimate, fusiform, ventricose, thick, opaque, chalky-whitish, wrinkle-striate. Whorls 10, a trifle convex, the first generally whitish-corneous, last whorl about one-third the total length, peristome lipped. Length  $23\frac{1}{2}$ , diam. 8, aperture with peristome 8 mill. long, 4 wide.

Var. Large, swollen, usually with a sixth tooth on the right margin. Length 27, diam. 9 mill.

Argentina: *Sierra de Cordora*.

*Odontostomus subsexdentatus* DOERING, Bol. de la Acad. Nacional Ciencias, Cordoba, 1875, p. 454.—*Bulinus* (*Odontostomus*) *subsexdentatus* KOB., Nachrichtsblatt d. D. Malak. Ges. viii, 1876, p. 6.—PFR., Monogr. viii, p. 609. — *Odontostomus pseudosexdentatus* DOERING, Periodico Zoologico i, pt. 3, p. 194 (1875).

Doering, in his second publication of this species, changed the name, without mentioning that previously given. His later diagnosis is as follows:

*O. pseudosexdentatus*. Shell rimate-perforate, ovate-fusiform, ventricose, thick, opaque, calcareous-whitish, wrinkle-striate. Spire attenuate, acuminate. Whorls 10, slightly convex, the first usually whitish-corneous, the rest calcareous whitish; last whorl about one-third the length, depressed on the side, anteriorly shortly and slightly two-crested at the base. Aperture angularly oblong-oval, obstructed by 5 teeth: one in the middle of the parietal wall, the second, horizontal, on the columella, third on the basal lip, fourth and fifth small, within the right margin.

Length 23, diam.  $7\frac{3}{4}$ , length of aperture  $7\frac{3}{4}$ , width 5 mill.

Length  $23\frac{1}{2}$ , diam. 8 to  $8\frac{1}{3}$ , length of aperture 8, width  $5\frac{1}{4}$  mill.

Length 23, diam. 8, length of aperture  $7\frac{3}{4}$ , width 5 mill.

The upper tooth of the outer lip is generally but little developed, rarely failing completely. The species varies a good deal in shape, there being two chief forms, a smaller normal one, and a larger, more ventricose form (*major*) with some traces of a tooth on the upper curve of the outer lip, and measuring:

Length 26, diam.  $9\frac{3}{4}$ , length of aperture  $8\frac{3}{4}$ , width 6 mill.

Length 27, diam. 10, length of aperture 9, width  $5\frac{2}{3}$  mill.

Length 27, diam. 9, length of aperture  $8\frac{2}{3}$ , width 6 mill.

The normal form is more frequent on calcareous hills around the valley of the Rio Primero, on the western slope of the Sierra de Cordova. The var. *major* predominates in the north of the Province, where Dr. Stelzner collected it at San Pedro.

O. KOBELTIANUS ('Doering' Kobelt). Pl. 12, figs. 80, 81.

Shell rimate, fusiform, rather thin, smooth, streaked with alternate corneous and opaque whitish, the apex regularly attenuated, generally decollate. Whorls 9-10, a trifle convex, regularly increasing, the last subcompressed at the base, forming a rather wide crest, a narrow deep pit above it. Aperture slightly oblique, angulate-ovate, with five folds arranged as in *O. chancaninus*, except that the uppermost on the outer lip is almost obsolete, while the middle one is deeply placed and shows through as a yellow spot outside. Peristome white, narrowly expanded, narrowly white-lipped within, the margins joined by a thread-like parietal callus, stronger at the ends, nearly interrupted in the middle. Length 27, diam. 7, length of aperture 8, width  $5\frac{1}{2}$  mill. (*Kob.*) *Argentine Republic.*

*Bulinus kobeltianus* Doering in litt., KOBELT, Jahrb. d. D. Malak. Ges. 1880, p. 291, pl. 9, f. 15, 16.

O. CHANCANINUS Doering. Pl. 12, figs. 78, 79.

Shell rimate, fusiform, ventricose, opaque, buff, calcareous, closely wrinkle-striate, the apex attenuated, frequently decollate. Whorls 9-10, a trifle convex, the first slightly substriate, those following coarsely and closely striate, the last whorl about one-fourth to one-third the total length, depressed in front, the base crested (second crest obsolete). Aperture angularly oblong oval; obstructed by 5 teeth: the first one high, slightly entering, on the parietal wall; another, larger and somewhat twisted, deeply entering on the columella; the other three within the outer lip, the upper one being small and tooth-like; peristome expanded, a little reflexed, thickened within, the right margin subarcuate above, basal and columellar margins a little reflexed, the margins joined by a callus. Length 27, diam. 8 mill., aperture with peristome  $8\frac{1}{3}$  mill. long,  $5\frac{1}{3}$  wide (*Doer.*).

Argentina; *Western slope of the Sierra de Aconijasta*, under rotten logs in the thorny woods.

*O. chancaninus* DOER., Periodico Zool. ii, pt. 4, p. 248 (1877); Jahrb. d. D. Malak. Ges., 1878, p. 134.—*Bulinus chancaninus* Doer., KOBELT, Jahrb. vii, 1880, p. 290, pl. 9, f. 13, 14.

Similar to *O. salinicola* and *O. subserdentatus*, but more ventricose and fusiform. It is smaller than the latter, the apical portion much more delicate, generally decollate, the striae are coarser, and the shell more fragile. It is larger and more ventricose than the former species. *O. chancaninus* is larger and more straightly tapering than *O. charpentieri*, which has the same arrangement of lamellæ and folds.

#### *O. SALINICOLA* Doering.

Shell rimate, fusiform, nearly smooth, scarcely pellucid, subopaque, variegated with irregular longitudinal pellucid corneous or corneous-brown stripes. Apex attenuated when perfect, and a little obtuse; frequently decollate; suture rather deep. Whorls 10, a little convex, the first 5 buff corneous, attenuated, those following somewhat variegated, substriate; the last whorl little impressed in front, two-crested at the base. Aperture angularly suboval, obstructed by 5 teeth; peristome expanded, somewhat acute, thickened within, the right margin lightly arcuate above, basal margin expanded, columellar margin reflexed. Length 22, width 6 mill.; aperture with peristome  $6\frac{1}{2}$  mill. long, 4 wide (*Doer.*).

Argentina: Saline plains at the foot of the western slope of the Sierra de Aconjigasta, Dep. Chancani.

*O. salinicola* DOER., Periodico Zool. ii, pt. 4, p. 247 (1877).

Of fusiform contour, with the first 5 whorls narrow, a little transparent, opaque in the middle but not calcareous in fresh specimens. The impression on the last whorl around the aperture is pretty distinct, and the aperture quite ample.

#### *O. BERGH* Doering.

Shell rimate, fusiform-turreted, pellucid, rather smooth or irregularly substriate, pellucid, pale corneous or brownish-corneous. Spire fusiform-turreted, the apex a little attenuated, slightly obtuse. Whorls 10, a little convex, the first corneous-brown, slightly substriate, the last usually paler, about one-fourth the length, impressed in front, strongly two-crested beneath. Aperture angularly sub-oval, obstructed by 5 teeth: peristome white, thickened within, widely ex-

panded, somewhat solute, the margins joined by a thick, compressed callus. Length 16–22, diam. 5–6 mill.; aperture with peristome  $4\frac{1}{2}$ – $5\frac{1}{2}$  mill. long,  $3\frac{1}{2}$ – $3\frac{2}{3}$  mill. wide (*Doer.*). *Argentina.*

*O. bergii* DOER., Periodico Zool. ii, pt. 4, p. 246 (1877).

This species has an extended distribution and varies within wide limits, preserving, however, certain definite characters, particularly the depth and length of the groove at the base, etc.

Var. *a*, from Alta Gracia, collected by Dr. D. C. Berg. Length 18–20, width  $5\frac{1}{2}$  mill.; of a narrow, very short form, light colored, corneous-white.

*b*. Cuesta de S. Antonio, Sierra Chica, region of Coco y Moya. Length 19–22, width 5–6 mill.; shell long and narrow, of darker color, only the last whorl is more or less whitish.

*c*. Cerro Salado, on the west slope of the Sierra de Aconjigasta. Length 19–21, width 6, apert. with perist.  $5\frac{1}{2}$  mill. long,  $2\frac{2}{3}$  wide. Teeth and peristome thicker.

#### *O. RETICULATUS* Doering.

Shell rimate, fusiform-turreted, corneous-brown or blackish-green, sculptured with very minute, elevated, close spiral lines. Suture rather deep. Whorls 9, somewhat convex, the first embryonal, coarsely striate, the last over one-fourth the total length, a little serobiculate-impressed in front, two-crested at the base. Aperture suboval, obstructed by 5 teeth; peristome expanded, thickened within, right margin subangular above, columellar margin reflexed, the margins joined by a parietal callus. Length 17–18, width 5 mill.; aperture with peristome 5 mill. long,  $3\frac{1}{2}$  wide (*Doer.*).

Argentina: *eastern slope of the Sierra de Aconjigasta*, the heights of Tablada, Plumeria, etc.

*O. reticulatus* DOER., Periodico Zool., ii, pt. 4, p. 250 (1877).

This species is intermediate between *Odontostomus* and *Macrodonates* [*Scalarinella*] in sculpture. The whorls, especially the upper ones, are very convex; the aperture and arrangement of teeth are in complete agreement with the allied species. The jaw has 13 plaits.

#### *O. MARTENSII* Doering.

Shell rimate-perforate, fusiform, ventricose, the apex acute; ashy-brown, longitudinally closely wrinkle-striate or subdecussately costulate-striate; somewhat variegated, with irregularly-spaced, lon-

gitudinal, brownish-corneous streaks. Spire somewhat swollen, turreted, the apex rather acute. Whorls 8, a little convex, the first buff-corneous, obsoletely striate, the rest closely rib-striate, decussated by 3 to 6 impressed, very minute, spiral lines; the last whorl scarcely two-fifths the total length, whitish, compressed at the side and shortly two-crested at the base. Aperture suboval, contracted by 5 teeth: one in the middle of the parietal wall, a horizontal one on the columella, a third in the base, the fourth and fifth small, within the right margin. Peristome white, expanded, the margins joined by a thin callus, right margin lightly arcuate above, basal expanded, columellar margin reflexed (*Doer.*).

Length 17, diam. 6, length of aperture  $5\frac{3}{4}$ , width 4 mill.

Length 19, diam.  $7\frac{1}{2}$ , length of aperture  $6\frac{1}{2}$ , width  $4\frac{1}{2}$  mill.

Length 20, diam.  $7\frac{1}{2}$ , length of aperture 7, width  $4\frac{2}{3}$  mill.

Argentina: northern part of the Province of Cordova, on granitic hills around Tortoral (Dr. Stelzner).

*Odontostomus martensii* DOER., t. c., p. 455 (1875); Periodico Zoologico, i, pt. 3, p. 181 (1875).—*B. martensii* Doer., Kob., Nachrbl., 1876, p. 6.—PFR., Monogr., viii. p. 610.

Distinguished by its sculpture, three fine spiral lines crossing the striae. In the Boletin, 1875, Doering gave the following description: Shell fusiform, ventricose, ashen-brown, closely costulate-striate, somewhat decussated by minute spiral impressed lines; variegated with irregular longitudinal spots of brown-corneous at irregular intervals. Spire swollen, turreted, the apex rather acutely tapering; whorls 8, a little convex, the last one two-fifths the length. Peristome slightly thickened, the margins joined by a thin callus. Length 19, diam.  $7\frac{1}{3}$ , aperture  $6\frac{2}{3}$  mill. long,  $4\frac{1}{2}$  wide (*Doer.*).

#### O. MULTISPIRATUS Doering.

Shell rimate, elongate, cylindric turreted, many-whorled, pellucid-corneous or subopaque, irregularly substriate, rather smooth. Whorls 12 to 13, a trifle convex, slowly increasing, the first a little convex, substriate, the rest somewhat variegated with whitish striae grouped in longitudinal streaks; last whorl but little impressed in front, the base obsoletely two-crested. Aperture ovate, normally contracted by 5 teeth; peristome white, expanded, the right margin subangular above, the margins joined by a rather thick, compressed, subsolute callus. Length 16–19, diam. 4 mill.; aperture with peristome  $3\frac{1}{2}$  to 4 mill. long,  $3\frac{1}{3}$  wide (*Doer.*).

Argentina: Quebrada de Yatan, de Nieve, Agua de los Oscuros, on the western slope of the *Sierra de Aconjigasta*.

*O. multispiratus* DOER., Periodico Zool. ii, pt. 4, p. 245 (1877).

Readily known by the long, slender form and numerous whorls. It varies somewhat, both in degree of elongation and in color, those living on slopes exposed to the sun being paler and more calcareous than those from shady places, which are darker colored.

*Group of O. neglectus.*

*O. LEMOINEI* Ancey. Pl. 12, fig. 84.

Shell rather slender, long and tapering, rather thin or somewhat solid, narrowly, obliquely perforate, tawny-gray, somewhat glossy. Spire long, regularly tapering to the somewhat obtuse apex. Whorls  $9\frac{1}{2}$ , regularly and slowly increasing, a little convex, separated by a simple and impressed suture, 4 or 5 earlier whorls nearly smooth, those following marked with obsolete, oblique riblets, the lower ones pallidly and irregularly vermiculate or wrinkled, the last whorl tapering, angular around the umbilicus, scarcely ascending, flattened and with a pit on the right side, oblong in form and scarcely larger than the preceding whorl. Aperture distinctly oblique, irregularly oblong, the outer margin angular above and below, showing teeth: a moderate sized parietal lamella, a prominent columellar lamella, a trifle twisted and simple, a large tooth opposite the rest within the right margin, and a thickened callus within the sloping basal margin, which joins the right margin at an angle. Peristome narrow at the insertion, elsewhere thickened, expanded, and at the base, and especially the columella, dilated; margins joined by a thin callus. Length 22, diam.  $6\frac{1}{4}$ , alt. aperture 6 mill. (*Ancey*).

Bolivia: *Santa Cruz de la Sierra* (Germain).

*Odontostomus lemoinei* ANCEY, Journal of Conchology vii, p. 93, fig. 1 on p. 97 (July, 1892); Le Naturaliste, August, 1892, p. 178.

Form *brevior* Anc. Shorter and relatively broader, the aperture larger, whorls 9. Length  $18\frac{1}{2}$ , width  $6\frac{1}{4}$ , alt. aperture scarcely 6 mill. (*Anc.*).

This form, quite a new one for Bolivia, is distinguished at a glance from similar species, such as *O. achanus* Doering, known to inhabit the Argentine Republic (*Anc.*).

*O. NEGLECTUS* (Pfeiffer). Pl. 12, figs. 82, 83.

Shell perforate, fusiform-turreted, thin; pale brownish corneous, with fine, irregular, sinuous whitish striae, which below the sutures become a regular series of short and very narrow folds. Outlines of the spire convex, apex obtuse, the first two whorls vertically and closely costellate. Whorls  $8\frac{1}{2}$ , slightly convex. Aperture ovate, the outer lip narrowly expanded, columellar margin broadly reflexed; columella having a strong fold above, bearing a very small, oblique, white lamella.

Length 21.5, diam. 6, length of aperture 6.8 mill.

Length 20.5, diam. 6.5, length of aperture 7 mill.

Length 19, diam. 6, length of aperture 7 mill. (*Pfr.*).

*Brazil.*

*Bulinus neglectus* PFR., Zeitschr. f. Mal. 1847, p. 67; Monogr. ii, p. 113; vi, p. 55.—*Odontostomus neglectus* DOHRN, Jahrb. d. D. Malak. Ges. ix, 1882, p. 105.—*Bulinus oblitus* REEVE, Conch. Icon. pl. 56, f. 376 (Dec., 1848).

The regular white costellation of the sutural border and very irregular and rather sparse whitish striae of the rest of the surface, are characteristic. The form varies from somewhat cylindric, as in Reeve's *oblitus*, to more conic, regularly tapering from the last whorl to the apex, as in Pfeiffer's original type, which is now in Dohrn's collection. It is very similar to *O. guarani* Orb., in the strong fold of the columella, the mouth being otherwise toothless. *O. jameirensis* differs in apical sculpture, that of *O. neglectus* consisting of rather coarse vertical riblets and finer spirals, being intermediate between the grated and costellate groups.

#### *Group of O. avellanedae.*

In the single species of this group these are no lamellae or folds. The apices of all the specimens I have seen are too much worn to show sculpture.

*O. AVELLANEDAE* (Doering). Pl. 11, figs. 56, 57, 58, 59.

Shell perforate-rimate, slender and tapering, rather thin, yellowish-olivaceous with some dark oblique streaks, and sometimes suffused with chestnut or smoky brown; glossy, sculptured with distinct growth-wrinkles, stronger below the suture, and sometimes showing very faint spiral striation. Whorls 7, scarcely convex, the last a

little flattened near the upper end of the outer lip. Aperture subvertical, ovate, less than half the total length of the shell; peristome white, *narrowly* expanded, the columellar margin dilated, parietal callus thin; columella oblique but foldless.

Length 22, diam. 9, length of aperture 9 mill. (Doering's type).

Length 22.5, diam. 8, length of aperture 9.6 mill. (Golfo Nuevo).

Length 19, diam. 7, length of aperture 8 mill. (S. Ventana).

Length 16.8, diam. 7, length of aperture 7.5 mill. (S. Ventana).

Argentina: *Sierra de Curumalan*, living with *O. rocæ* on quartzite rocks; *Sierra Ventana*, around Fuerte Argentino (Doering); *Golfo Nuevo* or *Bahia Nuevo* (von Ihering).

*Eudiptus arellanæ* DOER., Informe Oficial de la Comision Cientifica Exped. al Rio Negro, Zool., p. 64, pl. 1, f. 2, 3 (1881).—*Anctus* (?) *stearnsianus* PILSBRY, Nautilus x, p. 41 (1896).

A slender species, not very unlike the Argentine group of *Bulimulus* (Vol. x, p. 191), but more allied to *Odontostomus* or *Anctus* in the building forward of the aperture-margins. I have little doubt that it holds a relation to the group of five-toothed Argentine Spixias similar to that of typical *O. juneirensis* in comparison with *O. punctatissimus*. It is merely a species in which the apertural folds and lamellæ have degenerated, as in *O. patagonicus* of the same region. My description of this species under a new name was due to the original generic reference. It is totally unlike *Eudiptus*.

A specimen from Golfo Nuevo, some distance down the coast from Bahia Blanca, is yellowish-green, with faintly darker streaks, and is costulate-striate (pl. 11, fig. 58).

Figs. 56, 57, are from Doering's illustrations. Fig. 59 shows one of the types of the synonymous *stearnsianus*, from the Sierra Ventana.

#### Subgenus *PLAGIODONTES* Doering, 1876.

*Plagiodontes* DOER., Boletin de la Academia Nacional de Ciencias, ii, p. 318; Cordoba, 1876; type, *dentatus* Wood; Periodico Zoologico ii, pt. 4, p. 237 (1877).

Shell rimate, ovate or oblong, corneous or brown, with  $6\frac{1}{2}$ –8 compactly coiled whorls, the first  $1\frac{1}{2}$  having dense waved striae or straight riblets; last whorl large, scarcely pitted behind the lip except at the base. Aperture subvertical, truncate-ovate, obstructed by 3 principal lamellæ and folds, and a variable number, 0–5, of



small folds. The parietal lamella is angular and twisted, *composite*, being formed by the union of three lamellæ; and there is usually a transverse barrier standing behind the lower palatal fold. The jaw is plaited.

Distribution, Argentine Republic and Uruguay, chiefly in the La Plata drainage.

This subgenus differs from the other groups of *Odontostomus* in its short, compact shape, and the composite parietal lamella, which consists of three lamellæ—the angular, parietal and infraparietal, united into one angular, outwardly trifid tooth. In pl. 15, fig. 33, a young specimen of *O. dentatus* is figured, showing the separation of the three components of the parietal tooth, at a particular stage of individual development. In retaining these three lamellæ, *Plagiodontes* approaches *Tomigerus*; and as in that genus, it will be noticed that the infraparietal lamella is the longest, the true parietal being reduced. The basal and lower palatal folds are comparatively small, but the columellar lamella is far more developed than in *Tomigerus*, being the largest tooth in the aperture. No other *Odontostomus* has the transverse barrier standing within the series of lip-folds, which is possessed by all the *Plagiodontes* except *patagonicus*.

The teeth of the species are very similar throughout the subgenus, except in the *O. patagonicus*, in which they are partially degenerate.

In *O. dentatus* (pl. 15, fig. 25) and *O. patagonicus* the apex has very fine, waved striæ, faintly decussated by spiral lines. In *O. dædaleus* (pl. 15, fig. 32), and probably all the other species, it is finely costellate.

#### *Key to Species of Plagiodontes.*

1. Aperture almost closed by 7–10 teeth and a transverse plate behind them.
  - a. Surface merely wrinkled with growth lines; clear corneous.  
Uruguay, Entre-rios. *dentatus*, p. 94.
  - a'. Surface distinctly and closely striate.
    - b. Striæ almost rib-like; opaque-brown, whitish behind the aperture. S.-E. Argentina. *rocae*, p. 97.
    - b'. Striæ fine and close.
      - c. Shell *obese*, whitish, the sutures moderately impressed. *dædaleus*, p. 97.

- c*<sup>1</sup>. Cylindrical, the whorls flattened; corneous-whitish; 26x11 mill. *brackebuschi*, p. 100.
- c*<sup>2</sup>. Subcylindrical, the cone of spire very short; rufous-brown, a whitish keel above the sutures; whorls flat; 26x12 to 29x14 mill. *weyenberghi*, p. 100.
- c*<sup>3</sup>. Ovate-oblong, more slender than the other species; 27x10 mill. *multiplicatus*, p. 101.
2. Aperture comparatively open, with three moderate sized and often some smaller teeth; transverse barrier small or wanting. Bahia Blanca inland to Sierra Ventana. *patagonicus*, p. 95.

O. DENTATUS (Wood). Pl. 14, figs. 15, 16, 17; pl. 15, fig. 25.

Shell deeply perforate and rimate, oblong, of a dirty corneous tint, rather dull, faintly marked with growth-lines. Spire very convexly conic, the apex obtuse. Whorls about  $6\frac{1}{2}$ , moderately convex, aperture ovate, nearly closed by 8 or 9 teeth: a composite, deeply entering parietal lamella, a very large, spreading and partly vertical columellar lamella, a small, acutely compressed basal fold; and within the outer lip a similar lower palatal fold, an accessory fold often between these two; a large, twisted upper palatal, and a pair of contiguous superpalatal folds, connected at their bases; behind the lower palatal fold a high transverse lamella stands. Peristome white, thickened and narrowly reflexed.

Length 20, diam.  $8\frac{1}{2}$ , length of aperture  $8\frac{1}{2}$  mill.

Length 19, diam. 8, length of aperture  $8\frac{1}{2}$  mill. (Montevideo).

Length 16, diam. 8, length of aperture  $7\frac{1}{2}$  mill. (Montevideo).

Length  $16\frac{1}{2}$ , diam.  $7\frac{1}{2}$ , length of aperture 7 mill. (Montevideo).

Uruguay: *Montevideo*, in abundance (Martinez, Dr. W. H. Rush); *Colonia*. Argentina, prov. Entre Rios: *Feliciano and San José* (Orbigny); *Concordia and Mercedes*, among plants in sandy places (Paz); *Gualedguaychu* (L. D. Vries).

*Helix dentata* WOOD, Index Testac. Suppl., pl. 8, f. 71 (1828).—*Bulinus dentatus* WOOD, PER., Symbolæ ad Hist. Hel. iii, p. 54; Monogr. ii, p. 86; iii, 369; iv, 438; vi, 76; viii, 107, 612; Conchyl. Cab. p. 139, pl. 16, f. 4-6.—REEVE, Conch. Icon., pl. 38, f. 233.—HIDALGO, Viaje al Pacífico, Moluscos, p. 80.—*B. (Odontostomus) dentatus* STROBEL, Materiali per una Malacostatica di terra e di acqua dolce dell' Argentina Meridionale, p. 17, exclusive of *var.*

(1874).—*Tomigerus dentatus* MORCH, Catal. Yoldi, p. 29.—*Odontostomus dentatus* DOERING, Bol. Acad. Nac. Ciencias, Cordoba, 1875, p. 452; Periodico Zoologico i, pt. 3, p. 197 (1875).—*Plagiodontes dentatus* DOER., Bol. Acad. Cord. ii, p. 318; Periodico Zoologico ii, pt. 4, p. 238 (1877).—*B. (Plagiodontes) dentatus* KOE., Jahrb. 1878, p. 133.—*Pupa dentata* DESH. in FÉR., Hist., p. 218, pl. 162, f. 17, 18.—*Helix sowerbiana* FÉR., Prodr., p. 71, no. 492 bis (nude name).—ORBIGNY, Mag. de Zool., 1835, p. 22.—*Cyclodontina sowerbyana* BECK, Index, p. 88.—*Pupa sowerbiana* ORB., Voy., p. 321, pl. 41 bis, f. 15, 16 (exclusive of var. *patagonica*).—POT. et MICH., Galerie i, p. 173, pl. 17, f. 7, 8.—*Odontostomus (Plagiodontes) sowerbyanus* ORB., ANCEY, Le Naturaliste, May, 1901, p. 103.—*Pupa labyrinthus* in Berlin Museum, ANTON, Verzeichniss, p. 47, no. 1749 (according to Pfr.); nude name.

In most of the specimens from Montevideo the fold lying between the basal and lower palatal is wanting, as it was in Wood's type; but it is sometimes present or even represented by two folds. It occurs in specimens from Colonia and Entre Rios. Ancey mentions that in one specimen he found five irregularly placed denticles within the basal lip.

In the Montevideo shells the upper end of the composite parietal lamella, or that part representing the angular lamella, is usually a mere low buttress on the right side of the true parietal (fig. 15), but in some specimens from other localities it is more tubercular, and a low callous cord runs upward from it to near the termination of the outer lip. In immature specimens of *O. dentatus* at a certain stage the components of the parietal lamella stand separate upon the parietal wall (pl. 15, fig. 33).

*O. PATAGONICUS* (Orbigny). Pl. 14, figs. 20–24.

Shell deeply rimate, pupiform with conic spire, rather solid, light olivaceous brownish with darker longitudinal streaks; somewhat shining, sculptured with fine, irregular growth-striae. Last whorl subcylindrical or barrel-shaped, those above rapidly tapering, forming a rather short, conic spire. Whorls  $6\frac{1}{2}$  or 7, nearly flat, the last with a more or less distinct basal keel on its latter half, and having a small flattened tract within the keel behind the basal lip. Aperture vertical, shortly, irregularly ovate, obstructed by three principal lamellae and one or two smaller denticles or teeth: one curved

lamella well within on the parietal wall, bifid at its outer end; one very obliquely entering lamella on the columella; and a compressed upper palatal fold within the outer lip near its middle. Besides these there are in some specimens a small basal fold within the basal lip near the foot of the columella, and a suprapalatal fold within the outer lip above the upper palatal fold; one or two other folds being developed in some individuals. Peristome expanded.

Alt. 19-20, diam. 9, length of aperture  $8\frac{1}{3}$ - $8\frac{1}{2}$  mill.

Argentina: *Bahia Blanca*, in intervals of the dunes bordering the bay (Parchappe). *Sierra Ventana mountain system* and along the rivers arising therein, Rio Naposta, Rio Sauce-Chico, etc., and draining into the northern shore of Bahia Blanca. Not extending southwest to the drainage of the Colorado river, nor into the Sierra del Azul, etc. (Doering).

*Helix patagonica* ORB., Mag. de Zool., 1835, p. 22.—*Pupa sowerbiana* var. *patagonica* ORB., Voyage, p. 321, pl. 41 bis, f. 17, 18.—*Cyclodontina patagonica* BECK, Index, p. 88.—*Bulinus dentatus* var. *b*, PFR., Monogr. ii, p. 87.—*Bulinus patagonicus* ORB., PFR., Monogr. iv, p. 438.—*Plagiodontes patagonicus* d'ORB., DOERING Informe Oficial de la Comision Cientifica agregada al estado mayor general de la Expedicion al Rio Negro (Patagonia), Entr. i, Zoologia, p. 68, pl 1, f. 7, 8 (1881).—*Odontostomus (Plagiodontes) iheringi* PILS. & VAN., Proc. Acad. Nat. Sci. Phila., 1898, p. 473.

The specimens described above are what I formerly described as *O. iheringi* (figs. 23, 24); but the full information on *O. patagonicus* given by Doering shows that they are referable to that species. D'Orbigny described *patagonicus* from bleached shells from the shores of the Bay, larger than those before me from the Sierra, and having the peristome strongly thickened. The original figures are copied on my plate 14, f. 20, 21, and the original description here follows:

Shell short, ventricose, subperforate, thick, smooth; spire conic, whitish, the apex obtuse, striated. Whorls 7; suture flat. Aperture mask-like, rounded, with three large teeth, two on the columellar side. Columella flat, thick; lip very thick, reflexed. Length  $22\frac{1}{2}$ , diam. 11 mill. (*Orb.*)

Usually *patagonica* has but three teeth, but some individuals have besides these, some other small ones, frequently but slightly indicated, but located as in *dentatus*. The form of the shell is always more swollen and shorter than in that species. (From *Orb.*, Voy.)

This species differs from *O. dentatus* in the quite vertical aperture, the oblique, not subvertical, direction of the columellar lamella, the straight, instead of abruptly bent, upper palatal fold, and generally less developed dentition of the aperture. The transverse plate behind the lower palatal fold in *O. dentatus* is generally wanting in *patagonicus*, and the total number of teeth is normally 3 or 4, rarely 7 or 8. The ordinary size is 20–23 mill. long, though it may attain 27 mill. long, 12 wide. Dr. A. Doering, from whose account these details are taken, figures two specimens, the largest of which I have reproduced (fig. 22).

*O. ROCAE* (Doering). Pl. 14, figs. 18, 19.

Shell rimate, ovate-oblong, rather solid, brown, opaque, slightly shining; ornamented with close, nearly regular striae; spire ovate-subcylindrical, the apex conic, suture impressed. Whorls 8, a trifle convex, the first two nearly smooth, buff-corneous, the rest brown, *regularly sculptured with close, almost rib-like striae*, sometimes whitish; the last whorl about one-third the total length, chalky-white around the aperture. Aperture subvertical, ovate, calcareous, nearly closed by 8–10 folds, of which three are stout and lamelli-form: one angular, twisted and grooved parietal lamella, the second and largest tongue-shaped, on the columella, the third twisted, within the middle of the right margin; besides which there are 3 to 5 minute parallel folds within the basal lip, two small ones within the upper part of the outer lip, and a strong transverse lamella deep within the mouth. Peristome expanded, labiate, the margins joined by a callus. Length 21–24, diam. 8–9, length of aperture 7–9, width  $6\frac{1}{2}$ – $7\frac{1}{2}$  mill. (*Doer.*).

Argentina: *Southern slope of the Sierra de Curru-malan*, in damp, shady places.

*Plagiodontes rocae* DOERING, Informe Oficial, etc., de la Exped. al Rio Negro, Entr. i, Zoologia, p. 65, pl. i, f. 5, 6 (1881).

Distinguished from its allies by the dark color, becoming white near and in the aperture, the rib-striae, etc. The locality is near the Sierra Ventana.

*O. PEDALEUS* (Deshayes). Pl. 14, figs. 1–9.

Shell perforate and rimate, ovate, swollen, whitish, finely and densely striate. Spire conic. Whorls  $6\frac{1}{2}$ –7, rapidly increasing, the

last obese, having a pit behind the basal lip. Aperture vertical, ovate-truncate, nearly closed by the large teeth: a twisted, angular composite parietal lamella, bifid outwardly, a very large subvertical lamella upon the columella, two or three compressed folds within the basal lip, an oblique, twisted, large upper palatal plate-like fold in the middle of the outer lip, and two small tubercular, separated suprapalatal folds; standing within from the lower palatal fold there is an erect transverse barrier. Peristome thin, expanded.

Length 21, diam. 12 mill. (Deshayes' type).

Length 21, diam. 10-11, length of aperture 10 mill.

Length 19, diam. 10, length of aperture  $9\frac{1}{2}$  mill.

Argentina: *Provinces of Cordova and San Luis.*

*Pupa dædalea* DESH. in FÉR., Hist., ii, p. 217, pl. 162, f. 23, 24.  
—*Bulimus dædaleus* DH., PÉR., Conchyl. Cab., p. 194, pl. 56, f. 11-14; Monogr. iii, p. 370; iv, 438; vi, 76; viii, 613.—HIDALGO, Journ. de Conchyl., 1870, p. 51.—KOBELT, Jahrb. d. D. Malak. Ges., 1880, p. 286, pl. 9, f. 1-7; with var. *major* Doer., p. 287, f. 1, 2; var. *minor* Doer., l. c., f. 5, 6; var. *multidentatus* Doer., l. c., f. 7.—*Bulimus (Odontostomus) dædaleus* STROBEL, Mater. Malac. Argent., p. 16, with var. *major*.—*B. (Plagiodontes) dædaleus* DH., KOBELT, Jahrb., 1878, p. 133, with var. *strobelii* and *salinicola* Doer. (no description).—*Odontostomus dædaleus* DH., DOERING, Periodico Zoologico, Organo de la Sociedad Zoologica Argentina, i, entr. 3 (1875), p. 198-200, with var. *major*, *minor*, *multidentatus*.—*Plagiodontes dædaleus* DH., DOER., Per. Zool. ii, entr. 4 (1877), with var. *strobelii* (p. 239) and *salinicola*, p. 240.—*Odontostomus dædaleus* DH., MARTENS, Conch. Mittheil., p. 158.

A common species in central Argentina, at Cordova, etc.; the locality "Brazil" given by Deshayes being erroneous. It varies widely in form, and in the development of the minor folds within the basal lip. Deshayes' type had three basal denticles, but most of the specimens before me have but two, while Doering found a larger number in some forms of the species.

Var. *major* Strobel (1874). Shell with produced, acute, conic spire; two teeth within the basal lip of the aperture. Length 25, diam. 12 mill. (*Strobel*). Foot of the Sierra del Morro, near San Luis, province of San Luis (Herrero).

This is apparently identical with var. *major* ("major") of Doering, later in date. The latter (pl. 14, figs. 6, 7) is described as 24 to 26

mill. long,  $12\frac{1}{2}$  to 13 wide, with 7 whorls, aperture  $11\frac{1}{2}\times 9$  mill. It is said by Doering to be the normal form, encountered in great abundance in the Sierra de Cordova. According to Kobelt, who received a specimen from Doering, it is 30 mill. long, like the type in dentition of aperture or having two accessory folds between the two basals; whorls  $7-7\frac{1}{2}$ .

Var. *minor* Doer. (figs. 4, 5) is only  $19-23\frac{1}{2}$  mill. long,  $10\frac{1}{2}$  wide, and said to be somewhat more obese than the type, with typical teeth. It seems to me to be an absolute synonym of typical *dædalus*. It occurs chiefly in the more sterile and dry localities, around the peaks of the Sierra de Cordova.

Var. *multidentatus* Doering (pl. 14, fig. 9), predominates in dry places in the pampas. It agrees with var. *minor* in the obese shape, but the dentition is much stronger. Three strong cords run out from the lamella on the parietal wall, two from that on the columella. The first basal fold is doubled, and in place of the second there are three parallel folds running into the transverse barrier, and even visible upon it. There is another fold interposed below the large lamella (upper palatal fold) of the outer lip, and the surface of the large fold bears a strong ridge. The types measure, length 20, diam. 25, aperture  $10\times 8$  mill., whorls 6; and 25, 13, apert.  $11\times 9$  mill., whorls  $6\frac{2}{3}$ .

Var. *strobili* Doering (1877). Shell elongate, with acutely conic spire; the columellar lamella usually has a little tooth about the middle of its base; the secondary upper tooth of the parietal lamella is usually less prominent. The largest specimens were collected on the Cerro de Yerba Buena, in the Sierra de Aconjigasta, and measure: Length 30, diam. 13, apert. 12 mill., whorls  $7\frac{1}{2}$ ; length 33, diam. 14, apert. 13 mill., whorls  $7\frac{3}{4}$ . Further south a diminution in size is observable. For example, a specimen from S. Javier measures: 26, 12, 11 mill., whorls 7.

Var. *salinicola* Doering (1877). Of smaller size, and much less striate. The secondary superior tooth of the parietal lamella is separated entirely from the principal by a space. Length 23-26, diam. 12-13 mill., whorls 7. From the saline margins of the Laguna de Pocho.

O. BRACKEBUSCHII Doering. Pl. 14, figs. 10, 11, 12.

Shell cylindrical, longitudinally striated, opaque, subcalcareous,

corneous-whitish; apex shortly conic, rather obtuse, suture scarcely impressed, thread-like. Whorls 8, flattened, the first two nearly smooth, the rest elegantly and densely striated; last whorl about two-fifths the total length. Aperture vertical, ovate, nearly closed by 7 teeth, all remote from the margin. There are three thick lamelli-form teeth: one angular, twisted and grooved parietal lamella, the second tongue-shaped, on the columella, the third a twisted fold in the middle of the right margin; within the basal lip there are 2-4 minute folds, and 2 minute ones within the upper part of the outer lip; and there is a strong transverse lamella inward beyond the folds. Peristome lipped, expanded, the margins joined by a thin callus, the right margin subangular above. Length 26, diam. 11, length of aperture  $10\frac{1}{2}$ , width  $8\frac{3}{4}$  mill. (*Doering*).

Argentina: *Sierra de la San Luis at S. Francisco*.

*O. brackebuschii* DOER., *Apuntes Fauna Argent.* iii, in *Periodico Zoologico* ii, pt. 4, p. 240 (1877).—*Bulinus brackebuschii* Doer., KOBELT, *Jahrb.* 1878, p. 133; 1880, p. 288, pl. 9, f. 8-10.

This species scarcely differs in the structure of the aperture from *O. dædaleus*, especially the var. *multidentatus*, but it differs in its cylindrical, not swollen form, blunter apex and flat whorls, which show the young to be keeled. The basal impression is weaker than in *dædaleus*, and the minor denticles vary in the same way. It differs from *O. multiplicatus* Doer., in the wider, cylindrical shell, with shortly conoid, not elongated apex; the flat whorls and scarcely impressed suture. It is narrower, thicker and more opaque than *O. weyenberghi*, and without a keeled suture.

*O. WEYENBERGHI* Doering. Pl. 14, figs. 13, 14.

Shell rimate, subcylindrical, slightly ventricose, rather solid, rufous-brown, not glossy; encircled above the suture with a whitish carina. Spire somewhat club-shaped cylindrical, the apex shortly conic, tapering, slightly obtuse, suture flat. Whorls 7, flattened, the first nearly smooth, slightly convex, the rest delicately and densely striate, the last whorl scarcely exceeding half the length of the shell, encircled at the middle by a whitish band, sometimes obsoletely carinate, the base compressed, scarcely pitted. Aperture vertical, ovate, with 3 large and 4-7 smaller teeth: a large, sinuous parietal lamella with three external cords, another very large tongue-shaped and sinuous lamella on the columella, a third twisted and



subquadrate, in the middle of the outer lip, almost reaching to the margin, and 2-5 folds within the basal, 2 within the upper part of the outer lip, and some obsolete denticulation at the base of the columellar lamella; a high, transverse lamella deep in the aperture, and visible by translucence from the outside. Peristome broadly expanded, white, lipped inside, subangular above on the right side, the margins joined by a very thin callus. Length 26-29, diam. 12-14, length of aperture with peristome 12-13, width 10 mill. (*Kob.*).

Argentina: a few moist ravines, the "Nieve" and the "Mermela," on the western slope of the *Sierra de Aconigasta*.

*Plagiodontes weyenberghii* DOER., Apuntes, iii, in Periodico Zoologico, ii, pt. 4, p. 239 (1877).—*Bulinus weyenberghii* Doer., KOBELT, Jahrb., 1880, p. 289, pl. 9, f. 11, 12.—*B. weyenberghii* KOBELT, Jahrb., 1878, p. 133.

Close to the preceding species, but darker colored, with shorter, blunter apical cone, completely flat whorls, and with an acute carina, which extends to the aperture, at least faintly. The teeth are as in the two species preceding, only stronger, and seem to be equally variable.

The spelling "*weyenberghii*" was obviously a misprint for *weyenberghii*, the species being named in honor of Dr. D. H. Weyenbergh, Professor of Zoology in the National University of Cordova.

#### O. MULTIPLICATUS Doering.

Shell deeply rimate, ovate-oblong, closely, regularly striate, rather solid, opaque; spire elongate, the apex attenuated-acute. Whorls 7, a trifle convex, the last scarcely two-fifths the total length, with a slight basal crest. Aperture subvertical, ovate, nearly closed by 8-10 teeth, three of them large: the first angulate, twisted and grooved, on the parietal wall; the second tongue-shaped, excavated, on the columella; the third twisted, within the right margin. There are also 3-5 minute folds within the basal and two obsolete ones within the upper part of the outer lip, and a transverse fold deeper in the aperture. Peristome somewhat thickened, lipped, expanded, a little reflexed, the margins joined by a thin callus. Length 27, diam. 10, aperture with peristome  $10\frac{1}{2}$  mill. long, 8 wide (*Doer.*).

Argentina: *Cerro de Chepe*, province of Rioja (Stelzner).

*Odontostomus multiplicatus* DOERING, Periodico Zoologico, i, pt. 3, p. 196 (1875); Boletín Acad. nac. Ciencias, Cordoba, 1875, p. 452.—*Bulinus (Odontostomus) multiplicatus* KOB., Nachr. malak. Ges., viii, 1876, p. 5.—PFR., Monogr., viii, p. 612.

This species has not been figured. It is readily distinguishable from *dædaleus*, *patagonicus* and *dentatus* by its narrower form, more regular striation and more numerous teeth.

### Genus HYPERAULAX Pilsbry, 1897.

Proc. Acad. Nat. Sci., Phila., 1897, p. 10; Man. of Conch. xi, p. 82 (as a section of *Bulinulus*). Includes *Bonnanius* JOUSS., see below.

Shell umbilicate, ovate, with  $4\frac{1}{2}$ - $5\frac{1}{2}$  whorls, the apex sculptured with waved wrinkles. Aperture about half the total length, having a callous nodule at the posterior angle, more or less separated from the end of the lip by a groove; peristome reflexed, unarmed [or in the section *Bonnanius* having vertical upper palatal and columellar teeth, and usually two teeth (angular and infraparietal) on the parietal wall]. Soft anatomy unknown.

This group was formerly subordinated to *Bulinulus*, but I am now convinced that it belongs in the immediate neighborhood of *Auctus* and *Odontostomus*. The group probably was an early branch from the *Odontostomine* stock before it had split into the modern genera *Auctus*, *Odontostomus*, and *Tomigerus*.

The infraparietal lamella is the longest of those on the parietal wall, when any are present. This agrees with *Plagiodontes* and *Tomigerus*; while in other *Odontostominae* having lamellæ on the parietal wall, the parietal is longest. In *Tomigerus* the parietal lamella is small, in *Hyperaulax* (*Bonnanius*) it is wanting. *Auctus lamiferus* has a vertical, not entering, tooth upon the outer lip, analogous to, possibly homologous with, that of *Hyperaulax ramagei*. Until we know something of the pallial, muscular, digestive and genital systems of *Tomigerus*, *Hyperaulax* and *Auctus*, their mutual relations cannot be adequately understood.

Dr. O. von Möllendorff has recently (Nachr. d. D. Malak. Ges., 1901, p. 126) suggested that *B. ridleyi* belongs to the Buliminoid group *Napæus*, directing attention to its similarity to species of the Azores; but the latter do not have the apical sculpture of *Hyperaulax ridleyi*, and I regard the resemblance as a case of convergent evolution, perhaps due to some similar insular environmental factors, and not of phylogenetic significance.

The typical section of the genus includes the recent species *H. ridleyi* (Smith), of Fernando Noronha (Manual xi, p. 82), and the

oligocene *H. floridanus* (Conr.), of which *Bulimulus longævus* Ancey (Le Naturaliste, May, 1881, p. 414) is a synonym; *H. heilprinianus* (Dall); *H. stearnsii* (Dall), and *H. americanus* (Dall), Trans. Wagner Free Inst. Science, iii, pp. 5-7 (1890); all from the Silex Beds at Tampa, Florida.

*H. RIDLEYI* (Smith). Vol. XI, p. 82.

Some specimens are smaller than those described, one before me measuring, length 8.2, diam. 5, aperture 4.5 mill., with  $4\frac{1}{2}$  whorls. There is no pale band at the periphery, the whole shell being dull brown, with angular buff lines and dots. It is densely but superficially striate spirally. The nepionic shell consists of nearly 2 whorls, which are densely, minutely sculptured with waved wrinkles.

Section *Bonmanius* Jousseaume, 1900.

Bull. de la Société Philomatique de Paris, n. ser., ii, p. 39.

In this section the aperture is contracted by blunt teeth: two on the parietal wall, the upper (angular lamella) tubercular, the lower (infraparietal lamella) compressed and entering; one on the columella, and one (the upper palatal) within the outer lip. In view of the great variability of teeth in all the groups of *Odontostominae*, the group does not seem of more than subgeneric or sectional rank.

*H. RAMAGEI* (E. A. Smith). Pl. 11, figs. 60, 61, 62.

Shell subperforate and shortly rimate, obesely-ovate, solid, sculptured with fine wrinkles of growth and faint spiral lines; reddish-brown, encircled by whitish bands, four on the last whorl. Spire shortly conic, the apex obtuse, sculptured with close, vertical, waved wrinkles; last whorl very obese, rounded below, having a pit behind the outer lip, another behind the columellar lip. Aperture slightly oblique, irregularly ovate, brownish within, obstructed by four teeth: a small, tubercular angular, well separated from a thick, entering infraparietal lamella; a large squarish tooth on the columella, and a large vertical fold with irregular or crenate edge within the middle of the outer lip. Peristome thick, reflexed, and with the teeth, ivory white; parietal callus rather heavy, thickened into a low nodule at the posterior angle of the aperture.

Length  $18\frac{1}{2}$ , diam. 13, longest axis of aperture 11 mill.

Length  $23\frac{1}{2}$ , diam. 16 mill. (Smith, types of *ramagei*).

Length  $17\frac{1}{2}$ , diam.  $12\frac{1}{2}$  mill. (Smith, types of *ramagei*).

Length 22, diam. 15, length of aperture  $13\frac{1}{2}$  mill. (Jouss., type of *ouvieri*).

*Fernando Noronha Island*, imbedded in sandy mud on a raised reef at Tobacco Point (G. A. Ramage).

*Bulimus (Tomigerus) ramagei* E. A. SMITH, Journ. Linn. Soc. (Lond.), xx, Zoölogy, p. 500, pl. 30, f. 8 (1890.)—*Bonnanus bouvieri* JOUSSEAUME, Bull. Soc. Philomathique de Paris (ser. 9), ii, p. 39, pl. 1, f. 19 (1900).

Turbine, in cui la prima voluta è straordinariamente rigonfia: ha bocca prodigiosa per i quattro dente, che formano il buco, come di serratura tedesca. E' bianco dentro, castagnino fuori BUONANNI, Riecreatione dell' Occhio e della Mente, parte seconda, p. 185, f. 44 (1681); Latin edition, BONANNUS, Recreatio Mentis et Oculi (1684), p. 118, f. 44; Museum Kircherianum, classis xii, p. 452, f. 44 (1709).—*Bonnanus bonnanus* JOUSSEAUME, Bull. Soc. Philomath. (9 ser.), ii, p. 41 (1900), based upon Buonanni's figures and description.

Mr. Smith describes this species as having four white bands on the body-whorl, which agrees with the specimen before me (f. 60), from coll. G. H. Clapp; but his figure (f. 62) shows five bands. Two only of the twenty specimens examined by Smith exhibit any variation in the teeth of the aperture, these wanting the two parietal denticles. There is considerable variation in size.

The *Bonnanus bouvieri* of Jousseume (pl. 11, fig. 61) is clearly the same species, differing only in the longer fold within the outer lip.

Although introduced into scientific zoölogy by Mr. E. A. Smith in 1890, this species was first described and figured by a far earlier conchologist.

Making reasonable allowance for bad drawing, the Turbine no. 44, figured by the worthy Jesuit, Father Buonanni, in 1681, is evidently Smith's *B. ramagei*. The island Fernando Noronha was discovered by Amerigo Vespucci in 1503, his vessel lying there some eight days, with abundant and duly improved opportunity for observing the productions of the island, as we learn from his account of the voyage. It is thus quite likely that the specimen treasured in the collection of the Roman College of the Society of Jesus was collected and brought home by Vespucci or some of his crew. Neither Linnaeus nor Gmelin seem to have noticed the thrice-published figure of Bonnanus. It was M. Jousseume, in 1900, who first called attention to

Buonanni's figure, to which he applied the name *Bonnaninus bonnanius*. He was ignorant of the locality of the species and of Mr. Smith's work upon it, and not only misquotes the reference to Buonanni's work, but misspells his name, which Buonanni himself Latinizes "*Bonannus*."

### Genus TOMIGERUS Spix, 1827.

*Tomigerus* SPIX, Testacea Fluviatilia quæ in itinere per Brasiliam ann. 1817-1820, etc., coll. Dr. J. B. de Spix, legend on pl. 15, type *T. clausus*.

Shell turbinate or ovate, compressed from face to back, imperforate, but with a long umbilical chink; whorls 4-5, the spire more or less conic, apex smooth; last whorl compressed, with deep, oblique grooves behind the peristome. Aperture somewhat triangular, lateral, subvertical, seven-toothed; parietal lamella much smaller than the long angular and infraparietal lamellæ; three teeth on the straightened and sloping baso-columellar margin, a small supra-columellar and large, entering, columellar lamella, and a basal fold; outer lip bearing a single obliquely entering palatal fold. Soft anatomy unknown. Type, *T. clausus* Spix.

Distribution: Eastern Brazil to Venezuela.

This genus is allied on one hand to *Plagiodontes*, on the other to *Anostoma*. The armature of the aperture is exceedingly similar in all the known species. The homology of the erect, plate-like fold within the outer lip is not obvious; it may represent the united upper and lower palatal folds, or the upper palatal united with a suprapalatal and a transverse barrier like that of *Plagiodontes*. While specialized in shell-contour and armature of the outer lip, *Tomigerus* is primitive in the distinctness of the three parietal lamellæ.

Besides the following species, a "*T. globuloides* Mss.," from Brazil, is mentioned in Paetel's Catalog. (Edit. 4, 2 Abth., p. 211). No such species has been described by Mousson, to my knowledge.

### Key to Species of *Tomigerus*.

1. Shell whitish with brown bands; last whorl strongly distorted. umbilical suture long and straightened.
  - a. Spire depressed, low-conic; back of last whorl corrugated. *clausus*.

- a.*<sup>1</sup> Spire elevated, conic; nearly smooth; diam. about 20 mill. *gibberulus.*
2. Shell brown or corneous, not banded; spire elevated, conic.
- a.* Umbilical suture straight in the middle; whorls 5; diam. about 12 mill. *turbinatus.*
- a.*<sup>1</sup> Umbilical suture short, arcuate; whorls 4-4½; diam. 5¾-7½ mill. *cumingi.*

T. CLAUSUS Spix. Pl. 7, figs. 67, 68, 69, 70.

Shell compressed-ovate, distorted as though by pressure on the apertural side, imperforate, with a long, straightened umbilical suture; *white with numerous chestnut bands*, the widest one on the base, median bands more or less interrupted, and all disappearing on the front of the shell; the suture and umbilical rimation bordered with brown. Surface sculptured with faint growth-striæ except on the last half whorl, which is *strongly corrugated*, the riblets irregular, often anastomosing. *Spire low conic*; whorls 4½, the last distorted, excavated behind the columellar lip, and having an oblique groove behind the outer lip. Aperture vertical, somewhat triangular, with three lamellæ on the parietal, three on the sloping baso-columellar margin, and a large, obliquely entering plate-like fold within the outer lip, its upper end bifid. Peristome broadly expanded, white. Alt. 9, greater diam. 13, lesser 8 mill.

Brazil: *Province of Bahia*, at Almada in the Ilheos district, in primeval forest (Spix), and in the wood of Caxoeira (Blanchet).

*Tomigerus clausus* SPIX, Testac. Bras., pl. 15, f. 4, 5 (1827).—PFR., Monogr. i, p. 2; iii, 285; iv, 327; v, 438; Conchyl. Cab., *Helix*, pt. 2, p. 8, pl. 101, f. 19-21.—DESHAYES, Traité Élémentaire, pl. 83, f. 3, 4.—H. & A. ADAMS, Genera Rec. Moll. ii, p. 153, pl. 75, f. 4.—*Tomogeres clausus* PFR., Symbolæ iii, p. 52.—PHILIPPI, Abbild. u. Beschreib. ii, p. 131, *Helix* pl. 8, f. 14.—*Helix clausa* WAGNER in Spix, Testac. Bras., p. 21 (1827).—*Helix tomigera* MORICAND, Mémoire sur les Coquilles Terrestres et Fluviales envoyées de Bahia par M. J. Blanchet, in Mémoires de la Société de Physique et d'Histoire Naturelle de Genève, vii, p. 439 (see under *T. turbinatus*); xi, Troisième supplément au Mém. Coq. Terr. etc., p. 152, pl. 5, f. 13-16 (1845).—*Bulinus clausus* DESH. in Lam., An. s. Vert., viii, p. 255 (1838).—*Scarabus clausus* REEVE, Ann. and Mag. Nat. Hist. ix, p. 219, pl. 4, f. 1 (1842).—*Auostoma spixii* BECK, Index Moll., p. 34 (1837).

This species differs from others in the depressed spire, more distorted last whorl, corrugated surface and coloration. It is said by Spix and Blanchet to be rare. Four specimens before me vary in the color bands, but are otherwise alike.

**T. GIBBERULUS** (Burrow). Pl. 7, figs. 74, 75, 76.

Shell semiconic, subarcuately rimate, rather solid, nearly smooth; whitish, ornamented with wide brown bands. Spire conic, the apex blackish; whorls 5, the upper ones a little convex, the last longer than the spire, angular posteriorly, flattened on the apertural face, carinated at the base, ascending in front, having pits behind the aperture. Aperture vertical, subtriangular, somewhat effuse toward the right side, maculated with violaceous, obstructed by seven teeth: two on the parietal wall, the upper one oblique, long and serrate, the other transverse; three on the basal margin, their interstices purple-black; two on the outer margin, the upper one largest, long, the other compressed, superposed upon it. Peristome simple, white, broadly expanded, at the base reflexed. Alt. 13-14, greater diam. 20, lesser 11 mill. (*Pfr.*) Brazil: *Pernambuco* (Burrow).

*Helix gibberula* BURROW, Elements of Conchology, p. 188, pl. 27, f. 3 (1815); second edition, 1825, p. 177.—FERUSSAC, Prodr., p. 60.—*Tomigerns gibberulus* PFR., Zeitschr. f. Malak. 1849, p. 66; Monogr. iii, p. 284; Conchyl. Cab. *Helix*, pt. 2, p. 7, pl. 124, f. 1-3.—*Tomigerns principalis* SOWB., P. Z. S. 1849, p. 14, pl. Moll. 2, f. 6, 7.

**T. TURBINATUS** (Pfeiffer). Pl. 7, figs. 71, 72, 73.

Shell compressed-turbinate, imperforate, with a long, straight umbilical suture, *pale brown* and dull except in front, where it is somewhat glossy and corneous. Surface sculptured with *slight growth-wrinkles only*. Spire *elevated, conic*; whorls 5, convex, the last transversely dilated but not much distorted, ascending in front, deeply constricted and grooved behind the basal lip, and with a long, oblique impression behind the outer lip. Aperture slightly turned upward, nearly closed by the teeth, of which there are three lamellae on the parietal wall, three on the baso-columellar margin, and a single large obliquely entering plate-like fold within the outer lip, bifid at its upper extremity. Lip expanded, broadly flaring, pale flesh-tinted. Alt. 10, greater diam. 12, lesser  $7\frac{1}{3}$  mill.

Brazil: *Province of Bahia* (Blanchet).

*Tomogeres turbinatus* PFR., P. Z. S. 1845, p. 45 (September, 1845).—PHILIPPI, Abbild. u. Beschreib., ii, *Helix*, p. 131, pl. 8, f. 13.—*Tomigerus turbinatus* PFR., Conchyl. Cab., *Helix*, pt. 2, p. 9, pl. 101, f. 22-24; Monogr. i, p. 3; iii, p. 285; iv, 327; v, 438.—*Auricula clausa* POTIEZ et Michaud, Galerie des Moll., i, p. 201, pl. 20, f. 11, 12 (1838).—*Helix tomigeroides* MORICAND, Mém. Soc. Phys. et d'Hist. Nat. xi, p. 153, pl. 5, f. 10-12 (1846).—*Helix tomigera* MORICAND, Mém. vii, p. 439 (exclusive of references; no description or figure), teste Moricand, Mém. ix, 1845, p. 153.—*Anostoma tomigera* Moric., BECK, Index Moll., p. 34 (nude name).

This species seems to have been first collected by Blanchet, who sent specimens to Moricand. The latter took them for a bandless variety of *clausus* Spix; so that what he actually recorded in vol. vii of the Memoirs of the Geneva Society was *turbinatus*, though from the record there given it would appear to be *clausus*; the true state of affairs was seen by Beck, but no explanation was made public until Moricand's Third Supplement appeared, which, although submitted to the Geneva Society in May, 1845, was not published until 1846, and, therefore, after Pfeiffer had described the species as *T. turbinatus*.

T. CUMINGI 'Newc.' Pfeiffer. Pl. 7, figs. 64, 65, 66.

Shell compressed-turbinata, with a rather short, arcuate umbilical suture, thin, brownish-corneous, sculptured with light growth-wrinkles and delicate spiral lines. Spire conic, the apex obtuse; whorls  $4\frac{1}{3}$ , convex, the last but little distorted, deeply constricted and grooved behind the basal lip, having an oblique, curved impression behind the outer lip. Aperture small, slightly oblique, subtriangular, nearly closed by seven lamellæ and folds, the angular lamella running out to the end of the upper lip and somewhat connected therewith, the plate-like fold within the outer lip very deeply entering.

Alt.  $6\frac{1}{2}$ , greater diam. 7, lesser 5 mill.

Brazil: Para.

*Tomigerus cumingi* Newcomb MSS., PFR., Zeitschr. f. Malak., 1849, p. 67; Conchyl. Cab., *Helix*, pt. 2, p. 9, pl. 124, f. 12-14; Monogr. iii, p. 285; iv, 327; v, 438; viii, 490.—*T. venezuelensis* PFR., Malak. Blätter 1855, p. 148; P. Z. S., 1856, p. 36; Monogr. iv, p. 327.

Smaller than *T. turbinatus*, with fewer whorls and a more deeply entering palatal fold. The umbilical chink is arcuate. The following form is hardly separable, even as a variety.



Var. *venezuelensis* Pfeiffer.

Slightly smaller than *T. cumingi*, the spire a little less conic; whorls 4.

Alt. 5, greater diam.  $6\frac{1}{3}$ , lesser  $4\frac{1}{3}$  mill. (Pfr.).

Alt.  $5\frac{1}{2}$ , greater diam.  $6\frac{2}{3}$ , lesser  $4\frac{2}{3}$  mill. (Caracas specimen).

Alt.  $5\frac{1}{2}$ , greater diam.  $5\frac{3}{4}$ , lesser  $4\frac{1}{3}$  mill. (specimen).

Venezuela (Cuming coll., R. Tate); Caracas (F. Cocking).

Genus ANOSTOMA F. de Waldheim, 1807.

*Anostoma* F. de W., Museum Demidoff, ou Catalogue Systématique et raisonné des curiosités de la nature et de l'art données à l'Université Impériale de Moscou par S. E. M. Paul de Demidoff, iii, p. 230 (1807), for *A. octodentata* and *A. hexodon*.—*Tomogeres* MONTFORT Conch. Syst. ii, p. 358 (1810), for *T. ringens* = *A. octodentatum*.—JOUSSEAUME, Bull. Soc. Zool. de France, 1877, p. 311; *Tomogeriæ* of the same author, l. c.—*Tomogerus* BLAINVILLE, Dict. Sc. Nat. xxxii, p. 252.—*Angystoma* SCHUMACKER, Essai, etc., p. 229 (1817), for *A. resupinata* = *A. octodentatum*.—*Anastoma* JAN, Catal., p. 2 (1832), and of some other authors.

Shell heliciform, biconvex, solid, the axis hollow, but imperforate in the adult stage; composed of few whorls, the last straightened, turning toward the margin and upward; the semicircular aperture turned upward, obstructed by numerous lamellæ and folds; peristome expanded and reflexed.

Jaw smooth, arcuate (pl. 5, figs. 32, 33, *A. ringens*). Teeth as in terrestrial Holopoda generally, the centrals and laterals with single broad cusps, marginals short, with the ectocone developed (pl. 5, fig. 39). Genitalia (pl. 5, fig. 26) of the haplogonous type, the long slender penis passing into a long vas deferens, upon which the penis retractor muscle is inserted; duct of the globular spermatheca extremely long. Cerebral ganglia (pl. 5, fig. 34) connected by a short narrow commissure; suboesophageal ganglia (pl. 5, fig. 35) as usual in *Bulimulidæ*.

Type, *A. octodentatum* F. de W. Distribution, tropical South America, east of the Andes.

One of the most peculiar genera of land snails. The prominent feature of an upturned aperture (causing the adult snail to carry the shell spire down) is happily expressed in its name (*ana*, up, and *stoma*, mouth. Up to the last half whorl, the shell is umbilicate, and

judging by the growth-lines, carried with the equatorial plane nearly vertical; but at that period it falls or tilts to the *right*, not to the left as in *Helices*, and the subsequent growth of the whorl across the base necessarily follows. The "teeth" of the aperture are entirely homologous with those of *Odontostomus*. See page 27, fig. 3.

Unlike the shell, the soft anatomy is not especially peculiar, being, so far as known by Dr. Paul Fischer's account of *A. ringens*, essentially similar as regards the genitalia to that of *Odontostomus*, while the jaw and teeth are like *Macrodon*. The elongation of the whole genital system is greater than in Helicoid snails generally, and doubtless correlated with the unusual length of the last whorl. The cerebral ganglia are more separated than usual in the Holopoda.

*Key to Species.*

1. Angular lamella and upper suprapalatal fold concrescent, forming a perforation in the lip at its upper end. *ringens*, *carinatum*.
2. No perforation in the lip.
  - a. Typically 8-toothed.
    - b. A columellar lamella but no basal fold developed; two suprapalatal folds; lip white, broadly reflexed; shell angular at the periphery. *octodentatum*.
    - b.<sup>1</sup> A columellar lamella and a basal fold developed; shell more globose, not keeled. *deshayesianum*.
  - a.<sup>1</sup> Having 5-7 teeth; lip comparatively narrow, tinted; shell angular at the periphery. *depressum*.

1. *Group of A. octodentatum.*

*A. OCTODENTATUM* F. de Waldheim. Pl. 6, figs. 40-44.

Shell biconvex, the alt. half or nearly half the greatest diameter, solid, obtusely angular at the periphery. Brown-tinted whitish, the base copiously dappled with oblong spots and more or less spirally clouded with dull reddish-brown; upper surface having a broad reddish-brown band above the periphery, often mottled, and fading at its upper edge, and a narrow dark spiral band bordering the suture below, fading on the two earlier whorls. Surface slightly striate above, and on the first half of the base, the last half whorl regularly latticed or malleate in diamond pattern. Whorls 5, the first one flattened, the last half-whorl straightened, running to the periphery and up-turned, with three long and one short groove behind the lip.

Aperture subhorizontal, rounded, obstructed by eight folds; *the peristome white, very broadly expanded, reflexed and recurved*, rather thick, arcuate throughout, the parietal callus translucent-white, broadly spreading upon the last and preceding whorls. Parietal margin bearing three lamellæ: a small, triangular angle-lamella, a large, erect parietal lamella, the inner end of which curves behind the preceding tooth, and a smaller, straight infraparietal lamella near the middle of the parietal margin. Outer lip bearing five folds: subequal, straight and rather large upper and lower palatal folds within the outer margin, a somewhat smaller columellar lamella below them, and two still smaller suprapalatal folds on the upper margin, the upper one smaller and tuberculiform.

Alt. 21, greater diam. 45, lesser 33 mm.

Alt. 20, greater diam. 39, lesser 29 mm.

Eastern Brazil: *Prov. Parahyba* (Mousson); *Ceara* (Morelet).

*Anostoma octodentata* F. DE WALDII., *Museum Demidoff*, iii, p. 230, 231 (1807).—*Helix ringens* LINNEI, CHEMNITZ, *Conchyl. Cab.* ix, pt. 1, p. 86, pl. 109, f. 919, 920 (1786); WOOD, *Index Testac.*, pl. 33, f. 26 *a* (bad).—*Tomogeres ringens* MONTFORT, *Conch. Syst.* ii, p. 359, pl. 90 (bad).—PFR., *Symbolæ*, ii, p. 109.—*Tomogerus depressus* BLAINVILLE, *Man. de Malac.*, p. 459, pl. 39, f. 4, 4*a* (bad).—*Anostoma ringens* SOWERBY, *Genera Anostoma*, f. 1; reproduced in REEVE, *Conchol. Systemat.* ii, pl. 169, f. 1.—KÜSTER, *Conchyl. Cab.*, *Helix*, pl. 12, f. 5, 6 (reproduced from Chemnitz), and pl. 12\*, f. 4–6.—PFR., *Monogr.* i, p. 1; iii, 284.—ADAMS, *Gen. Rec. Moll.*, p. 198, pl. 77, f. 8.—DESHAYES, *Traité Elém.*, pl. 83, f. 1, 2.—MOUSSON, *Malak. Bl.* xvi, 1869, p. 172.

*Anastoma* (or *Anostoma*) *depressum* SOWERBY, *Conchol. Manual*, p. 5, f. 271, 272; edit. 2, p. 65.—*Angystoma resupinata* SCHUMACKER, *Essai d'un Nouv. Syst. Vers Test.*, p. 229 (1817).

Not *Helix ringens* LINNÉ. Not *A. depressa* Lam.

This is the largest species of the genus, distinguished from the next chiefly by its more depressed form and the absence of a "basal fold" at the junction of the lower and outer margins of the lip. The broader white lip, more numerous teeth and generally larger size separate it from *A. depressum* Lam.

*A. DESHAYESIANUM* Fischer. Pl. 6, figs. 46, 47.

Shell orbiculate-globose, lightly striate, hardly shining, covered

with a corneous epidermis, composed of 5 convex whorls. Spire obtuse; suture hardly impressed, not marginate, bordered below by a blackish band. *Last whorl globose, not carinated*, divided by a submedian blackish band above, the upper part having only a few spots near the periphery, the base with numerous brown spots arranged concentrically. Aperture semilunar, a little oblique, the columellar [parietal] margin arcuate, convex, three-toothed, the median tooth most strongly developed; peristome white, reflexed, provided with six equidistant and equal white teeth, violaceous at their bases. Alt. 18, greater diam. 33, lesser 24 mill. (*Fischer*).

*Brazil* (Deshayes coll.).

*Anostoma deshaysianum* FISCHER, Journ. de Conchyl. v (2d ser., vol. i), p. 350, pl. 12, f. 1, 2 (Jan., 1857).—PFR., Monogr. iv, p. 326.—? REEVE, Conch. Icon., f. 5 a, b.

Differs from *A. octodentatum* by the more globose form, absence of a carina and arrangement of the teeth, there being two teeth (columellar lamella and basal fold) instead of but one, upon the lower margin of the lip. Judging from the figure, the median tooth of the parietal margin is less oblique than in *A. octodentatum*. Reeve's figure is probably a small form of *A. octodentatum*, not the real *deshaysianum*.

*A. DEPRESSUM* Lamarck. Pl. 6, figs. 48–54.

Shell biconvex, the alt. about half the diameter, angular at the periphery, whitish, more or less brown-tinted, the base dappled with oblong spots or streaks arranged concentrically, having a dark band along the basal suture, the upper surface sparsely spotted near the periphery, and having a brown band revolving below the suture, usually with a fainter one above it. Surface finely striate above and below, fresh specimens showing dense fine spiral lines, especially on the last whorl. Whorls  $4\frac{2}{3}$ , nearly flat, the last *angular or carinated at the periphery*, its last half straightened and turned upward, showing two or three grooves or pits behind the lip. Aperture subhorizontal, semicircular, obstructed by 5 or 6 teeth; peristome expanded and reflexed, *pinkish-brown or flesh tinted*. Parietal margin bearing two or three teeth; a minute tubercular angle-lamella often obsolete, an erect, compressed parietal lamella, and a small infraparietal lamella at about the middle of the parietal margin. Outer margin with three (or four) folds; columellar fold usually wanting; upper and

lower palatal folds well developed, the former a little larger and more oblique; suprapalatal fold tubercular, small or minute.

Alt. 15, greater diam. 31, lesser 24 mill.

Alt.  $17\frac{1}{2}$ , greater diam. 34, lesser  $25\frac{1}{2}$  mill.

Brazil: *Banks of the Amazon River* (E. Verreaux); "*Rio del Norte*" (Coll. Acad. Nat. Sci.).

*Anostoma depressa* LAM., An. s. Vert., vi, pt. 2, 101 (exclusive of most references); Edit. Deshayes, viii, p. 152.—*Helix* (*Helicodonta*) *ringens* FERUSSAC, Histoire, pl. 53, f. 3–5.—*Anostoma verreauxianum* HUPÉ, Journ. de Conchyl. v (2d ser., vol. i), p. 352 (1857), and in Castelnau, Expéd., p. 22, pl. 3, f. 5.—PFR., Monogr. iv, p. 326; v, p. 438.—REEVE, Conch. Icon. xiv, pl. 1, f. 4a, 4b.—? *Helicodon ringens* SOWB., Catal. Shells Coll. Tankerville, p. 35 (1825).

Distinguished from *A. octodentatum* chiefly by the narrower and tinted lip, and fewer teeth. It is usually smaller, more angular at the periphery, and less densely mottled beneath.

LAMARCK's original description of *A. depressa* is as follows: "Shell suborbicular, convex on both sides, a little depressed, obtusely carinated, imperforate, glabrous; whitish with a circular reddish line above; aperture five toothed; lip strongly reflexed." He further remarks that it is sometimes spotted beneath, and has five teeth, two on the columellar margin (parietal wall), and three on the right lip. Greatest diam. 16 to 17 lines (= 32 to 34 mill.). The species has usually been placed under *A. ringens* of authors (*A. octodentatum* F. de W.), as a synonym, but the size, number of teeth, carina, etc., indicate that the shell Lamarck had was what Hupé described later as *A. verreauxianum*.

*A. verreauxianum* measures: alt. 15, greater diam. 30, lesser 23 mill., according to Hupé. Neither Hupé nor Pfeiffer mention the positions of the teeth of the outer lip, but Hupé's figures (pl. 6, figs. 53, 54) show that in the type, the columellar lamella and upper and lower palatal folds are developed. Reeve figures a specimen (my fig. 45) in which in addition to these, a suprapalatal appears, making six teeth in all.

In the specimens of *A. depressum* before me there is some variation, but all agree in wanting a columellar lamella. One of them (pl. 6, figs. 50, 51, 52) labeled by Robert Swift as purchased from Verreaux, and marked *verreauxianum* by the latter, has two parietal lamellæ, the parietal and the infraparietal, and upper and lower

palatal folds, with a minute upper suprapalatal. Another, received by Swift from Bernardi, has in addition a punctiform angle lamella, and the lower one of the suprapalatal folds.

Still another shell (pl. 6, figs. 48, 49) labeled "near Rio del Norte, Brazil," is more acutely carinated, with teeth like the specimen last mentioned.

2. *Group of A. ringens.* (Section *Ringicella* Gray.)

*Ringicella* GRAY, P. Z. S., 1847, p. 172, for *A. globulosa*.—*Tomogerina* JOUSSEAUME Bull. Soc. Zool. de France, 1877, p. 312, type *A. globulosum* Lam.

A tendency toward the formation of a sutural channel may be seen in *Cyclodontina* and *Hyperaulax*, though it is not closed over in these forms, as it is in *Ringicella*.

*A. RINGENS* (Linné). Pl. 5, figs. 27–29, 32–36; Pl. 7, figs. 55–61.

Shell biconvex, solid, brownish-yellow, with a dark-brown band above the periphery, another bordering the suture; the base rather sparsely marked with irregular reddish-brown spots and usually having a dark stripe below the basal suture. Surface hardly shining, the last whorl densely corrugated in zigzag pattern, but sometimes this sculpture is almost obsolete. Whorls  $4\frac{2}{3}$ , the last carinated at the periphery, having three deep, dark-colored grooves and one small one behind the lip. Aperture subhorizontal, elevated above the periphery, obstructed by six white teeth: two strong lamellæ upon the parietal wall, the parietal lamella compressed, curving upward within, the infraparietal stouter and straight; outer lip broad, expanded and reflexed, white, its upper end perforated by an oval hole; outer margin with four long folds within, of which the columellar and the lower and upper palatal are subequal, the inner end of the latter being strongly bent upward; suprapalatal fold smaller and oblique, almost transverse; above it may be seen a small upper superpalatal fold, which has united with the angle-lamella to form the wall of the respiratory foramen, perforating the end of the lip.

Alt. 13, diam. 25 mill.

Alt.  $10\frac{1}{2}$ , diam. 18 mill.

Brazil: *Rio Negro* (Anthony, in coll. A. N. S.).

*Helix ringens* LINNÉ, Syst. Nat. (10), p. 769, 1758 (exclusive of references); cf. HANLEY, Ipsa Linn. Conch., p. 363.—*Anostoma*

*globulosa* LAM., An. s. Vert. vi, pt. 2, p. 102; edit. Desh., viii, p. 153.—BECK, Index, p. 34.—REEVE, Conch. Syst. ii, pl. 168, f. 2.—*A. globulosum* KÜSTER, Conchyl. Cab., *Helix*, pl. 101, figs. 29–32.—DESHAYES in Encycl. Méth., ii, p. 52, and in Fér., Histoire, i, p. 399.—PFR., Monogr. i, p. 3; iii, 284; iv, 327; v, 438.—REEVE, Conch. Icon. f. 2 *a. b.*—FISCHER, Journ. de Conchyl. 1869, p. 209, pl. 11, f. 1–5; 1871, p. 261, pl. 11, f. 4–8 (anatomy).—*Anostoma globulosa* MACGILL, Conch. Text-book, ed. vi, p. 106, pl. 13, f. 25. *Helix globulosa* GUERIN, Iconogr. Moll., pl. 6, f. 2.—*Helix (Helicodonta) ringicula* FER., Prodr., no. 114; Hist., pl. 53, f. 1, 2.—*Anostoma ringiculum* SCHAUF., in Paetel's Catal., p. 98.—*Helicodon ringiculus* SOWB., Catal. Shells Coll. Tankerville, p. 35, no. 888 (1825).—*Anostoma hexodon* F. DE WALDHEIM, Mus. Demidoff, iii, p. 231 (1807).—? *Lucerna antiqua* HUMPHREY, Museum Californianum, p. 61, no. 1128 (1797).

Variable in size, degree of carination, and development of the wrinkle-sculpture; some specimens being merely striate, with only traces of corrugation, while others, usually the larger specimens, are strongly corrugated beneath and above the keel on the last whorl. In a series of seventeen specimens in the collection of the Academy there seems to be a gradual passage between the extremes. In one specimen there is a fold midway between the two palatals (fig. 61).

The size of the perforation in the peristome varies widely, in specimens of the same size, and it may enter either directly or obliquely. The maculation of the base is usually rather sparse, but occasionally copious, and in one specimen before me spots are wanting.

*A. ringens* is the longest-known and commonest species of the genus, yet no definite locality for it has been published.

**A. CARINATUM** Pfeiffer. Pl. 7, figs. 62, 63.

Shell with a long basal suture, conoid-lenticular, rather solid, acutely carinate; pale, narrowly banded with chestnut above the keel and at the suture. Spire shortly conoid; whorls 5, rather flattened, the upper ones striatulate, the last with irregular and waved rib-striae; the base convex, spotted with chestnut, scrobiculate in front. Aperture following the slope of the spire, semicircular, contracted by six strong, curved lamellæ; peristome white, broadly expanded and reflexed, the right margin provided with a large foramen at its insertion. Alt. 13, greater diam.  $24\frac{1}{2}$ , lesser 19 mill. (*Pfr.*).

*High forests of the Magdalena river region, 6000 ft. above the sea (Wallis); Brazil (Mus. Dennison).*

*Anostoma carinatum* PFR., Zeitschr. f. Malak., 1853, p. 57; Monogr. iii, p. 650.—REEVE, Conch. Icon., xiv, pl. 1, f. 1 a, b (1863).—MOUSSON, Malak. Blätt. xvi, p. 172.

This is probably a mere variety of *A. ringens* L., characterized by its strong keel, strong sculpture and large foramen in the lip; but these characters vary widely among specimens of *A. ringens*. Reeve's indifferent figures are copied on my plate.

## APPENDIX TO BULIMOID SNAILS.

Genus STROPHOCHEILUS Spix. (Vol. X, p. 1).

Subgenus STROPHOCHEILUS.

*S. pudicus* (Müller). Pl. 17, figs. 39, 40.

Pfeiffer identified *H. pudica* Müll. with the species I have named *erythrosoma*, and reversing the usage of former authors, he calls the shell long known as *B. pudicus*, *B. almeida*. As the reasons for a different course are not given in vol. x, it may be best to re-open the question here. I give on plate 17 copies of Chemnitz's figures of Müller's type. Müller's diagnosis and description are as follows:

"*Helix pudica*. *Helix* testa oblonga, rugulosa, rosacea, apertura edentula; labro dilatato, *candido*. Long 20 lin. lat. 9 lin.

"Testa ovato-acuminata, nitida ex candido & roseo mixta, rugulis minutissimis ubique vestita. *Anfractus vix sex*, extimus quinis vicino & reliquis simul sumtis major. Faux alba; apertura ovato-oblonga; labrum adnatum roseo flavescens. Centrum axis sub labro perforatum. In Museum Spengleriano."

The italics are my own, and call attention to characters—the white lip and nearly 6 whorls—which show the original *H. pudica* to be different from *S. erythrosoma*. In *erythrosoma* the largest specimens have only  $4\frac{3}{4}$ , while smaller shells, the size indicated by Müller, have but  $4\frac{1}{2}$ , and the contour of the shell is wider. Chemnitz's figure of Müller's type, from Spengler's collection, shows 5 whorls, and his description gives "only six." The upper whorl being planorboid in *Strophocheilus*, does not show in a front view. It will be noticed that



the columellar lip is distinctly dilated above. In *S. erythrosoma* it is narrower.

From the existing data I conclude that the original "*Helix pudica*" of Müller was either a small individual of *S. almeida* Spix, or a distinct species, not yet rediscovered, closely allied to *almeida*. For the present, it may be best to accept the former alternative. In support of this conclusion, I figure the smallest individual before me (pl. 17, fig. 41) for comparison with Chemnitz's figures (f. 39, 40).

The reference to "Malak. Bl., 1857, p. 179," in third line of reference paragraph on p. 7 of vol. x, should be deleted. The references to Müller, Gmelin, Bruguière, Chemnitz and Dillwyn belong to *S. pudicus* as restricted above to the original small form. "*S. almeida*" differs from *S. pudicus* chiefly in the larger size and in having a whorl less, judging from the published account of the latter. The figures in vol. x pertain to "*almeida*."

It was evidently *erythrosoma* which Martens reported from Rödersburg (vol. x, p. 194).

*S. ERYTHROSOMA* Pilsbry. (Vol. x, p. 10.) Pl. 17, figs. 42-45.

This species differs from *S. pudicus*, as figured by Chemnitz, in the broad contour, compressed from face to back, and "humped" on the left side (while in *pudicus* the form is slender and the curve of the left side is even); in the concave and narrow columellar lip, merely rimate axis, not openly perforated, as in *pudicus*, and in other characters mentioned in my original description.

The specimen described and figured by Pfeiffer (pl. 17, fig. 44, 45) as *B. pudicus* was smaller than any I have seen, length  $44\frac{1}{2}$  mill. Others from Iguape, sent by Dr. H. von Ihering (pl. 17, figs. 42, 43), measure: length 59, diam. 31, longest axis of aperture 32 mill., and length  $50\frac{1}{2}$ , diam. 28, aperture 29 mill.

A perfect specimen is covered with slightly olivaceous yellow cuticle which appears of a deep reddish, almost mahogany color, over the rose-colored parts of the shell. There are nearly 2 post-nepionic whorls, the nepionic portion being sculptured with close, slightly oblique, rib-striae.

Southern Brazil: *Iguape*, prov. S. Paulo (v. Ihering); *Rödersberg* (Martens).

*Bul. pudicus* Müller, PFR., Malak. Blätt. iv, 1857, p. 179, 180, pl. [4], f. 1, 2.—MARTENS, Malak. Blätt. xv, 1868, p. 178. Not of Müller!—*S. erythrosoma* PILS., Man. Conch. x, p. 10.

*S. PILSBRYI* von Ihering. Pl. 17, figs. 46, 47.

Shell perforate, oblong, moderately solid, chestnut brown, with a blackish line followed by an ill-defined yellow band below the suture; irregularly plicatulate and beautifully granose microscopically throughout, the granulation barely visible to the naked eye, and arranged in regular spiral series; spire thick, obtuse. Whorls 5, the first one planorboid, the next tumid above; last whorl oval, convex, its later half more descending, shortly ascending at the aperture. Aperture ovate, bluish within; peristome reflexed, red; columella oblique and straight above, concave below, its margin dilated above, almost closing the narrow perforation. Length 48, diam. 24 mill.; aperture 25 mill. long.

Brazil: *Piquete (Serra da Mantiqueira)*, Sao Paulo (H. v. Ihering).

*Strophocheilus pilsbryi* v. IHER., Proc. Acad. Nat. Sci. Phila. 1900, p. 394, pl. 11, f. 4 (August 9, 1900).

This species seems to be allied to *S. rhodocheilus* (Reeve), but has not the color-pattern or columellar fold of that species, the aperture is smaller, and the surface irregularly plicatulate as well as granulous. The original description is given above, and the type figured. There are three nepionic whorls, densely striated spirally, the striae granulose. An oblique impression marks the end of the nepionic period.

*S. MILLERI* var. *KRONEI* v. Ihering, n. v. Pl. 19, figs. 58, 59.

Shell similar to *S. milleri*, but broader, *more inflated*, the aperture more oblique, peristome dark purple, less reflexed above; spire very dark, being violet under the thin cuticle, the last whorl rich chestnut, glossy with dull zones. Length 62, diam.  $32\frac{1}{2}$ , longest axis of aperture  $34\frac{1}{2}$  mill.

Brazil: *Rio Grande, Prov. Sao Paulo*. Type no. 1122 coll. Museu Paulista.

The type and only specimen I have seen has lost some of the cuticle, but what remains shows the lustrous zones of *milleri*, with which species it agrees in having 5 whorls, somewhat plicate spire and oblique last suture. The adnate portion of the reflexed columellar lip is thinner than in *milleri*, closely appressed and concave, leaving no umbilical chink whatever, and the columella is somewhat sinuous. The spiral striae are less granulose than in *milleri*. This form may prove specifically distinct.

Var. IGUAPENSIS n. v. Pl. 18, figs. 48, 49.

Shells denuded of cuticle have the spire violet, the last whorl paler, flesh-colored, lip pink. The last whorl and aperture are broader and shorter than in *milleri*. Lip well reflexed; the reflexed, thick columellar lip leaves an umbilical chink below; columella straight. Length 59, diam.  $32\frac{1}{2}$ , longest axis of aperture  $32\frac{1}{2}$  mill.

Brazil: *Ignape, S. Paulo* (Dr. H. von Ihering).

In this variety the length of the aperture equals the diameter of the shell, while in *milleri* and *kroneri* it exceeds it slightly. The crowded, fine spiral striae are smooth, while in *milleri* they are granulose.

S. CALUS n. sp. Pl. 18, figs. 46, 47.

Shell deeply rimate, oblong, solid and strong; rose colored, fading to white in some places, under a thin yellow cuticle (which is in large part wanting in the type). Surface densely sculptured with waved striae, which on the last whorl anastomose to form a netted pattern; conspicuously malleated. Whorls  $5\frac{1}{3}$ , the first obtuse above, the earlier 3 composing the conic, closely obliquely striate nepionic shell. Sutures moderately impressed, beyond the nepionic shell becoming progressively more oblique to the last half turn, which is about parallel to that above it, and ascends in front.

Aperture slightly oblique, ovate, flesh-tinted within, *peristome very broadly reflexed and recurved*, the outer lip regularly arcuate, its upper half rose colored, lower half with the basal lip yellowish; columellar margin broadly reflexed, standing free above the rather long curved, compressed axial chink, rose colored; columella strongly folded, the fold white; parietal wall covered with a thick, transparent, roseate enamel. Length 63, diam. 30, longest axis of aperture with peristome 36 mill.

Brazil. (Type no. J 4668, coll. Amer. Mus. Nat. Hist.)

This beautiful species has a stronger columellar fold than *S. almeida*, is heavier, and there is no umbilical perforation as in that species, but merely a rather long, curved chink, over which the wide columellar lip projects. The apex is more acute than in *S. erythrosoma*. It may be related to *S. rhodocheilus* (Rve.) but has neither the sculpture or color pattern described for that species. *S. contortuplicatus* (Reeve) has a much narrower peristome and different sculpture. In *S. calus* there is no minute granulation, and no spiral striation.

I am indebted to Mr. L. P. Gratacap, of the American Museum, for the opportunity of describing and illustrating this species.

Subgenus BORUS Albers, 1850.

Vol. x, p. 10. Add to references: *Megalobulimus* MILLER, Mal. Blätter xxv, p. 172, for *garciamoreni* = *popelairianus*.—*Corus* JOUSSEAUME, Bull. Soc. Zool., France, 1877, p. 311 (Oct. 1877).

*S. MAXIMUS* (Sowb.). Vol. x, p. 15.

Mousson reports specimens 140 and 160 mill. long, locality not given. Possibly they were *popelairianus*, which is very closely allied, if really distinct. (Mal. Bl. 1873, p. 4.)

*S. YPORANGANUS* v. Iher. & Pils., n. sp. Pl. 19, figs. 56, 57.

Shell almost imperforate, long-ovate, solid, chocolate-brown, paler behind the lip, and with a *yellow band bordering the white-edged suture below*; sculptured with rather coarse wrinkles of growth, and *densely finely granulose in spiral series throughout*. Whorls  $5\frac{1}{2}$ , the first smooth, planorboid, two following granulose and crossed by *very strongly elevated, narrow and wide-spaced ribs*. Post-nepionic whorls exactly 2, the last half-turn of the suture somewhat oblique to the preceding. Aperture slightly oblique, blue with a pearly luster inside, not much exceeding half the length of the shell, acutely ovate; peristome deep rose-color, thickened, very narrowly expanded; columella concave, with a slight fold above; the reflexed columellar lip and the parietal callus rose-colored. Length 91, diam. 48, longest axis of aperture 50 mill.

Brazil: *Yporanga*, Prov. *Sao Paulo* (type no. 65. coll. Museu Paulista).

In the form and the color of the aperture it is much like *S. granulatus*, but *S. yporanganus* is more coarsely granulose, with shorter mouth and diverse sculpture of the nepionic shell, the riblets in *granulosus* being comparatively fine, close and short.

*S. BRONNI* (Pfr.), var. *PERGRANULATUS* nov.

See Vol. x, p. 28. A specimen from Piquete, *Sao Paulo*, sent by Dr. von Ihering, is densely granulose to the lip, the folds of the spire are perceptibly coarser than in *bronni*, the penultimate whorl is larger, and the last half-turn of the suture is scarcely more oblique

than the corresponding suture above it. This subspecies may be called *pergranulatus*, as it is clearly differentiated from the typical *bromi*, in which the granulation becomes obsolete on the last whorl, and the latter half-turn of the suture usually descends more obliquely.

Type no. 71231 coll. A. N. S., from no. 912 of von Ihering's register.

*S. FRAGILIOR* von Ihering, n. sp. Pl. 20, figs. 60, 61.

Shell imperforate, oval, as solid as *S. bromi*, the last whorl of a deep, rich brown color with darker streaks, preceding whorls profusely maculate and suffused with golden-buff.  $3\frac{1}{2}$  nepionic whorls, with sculpture of granules in spiral series, and strong, short folds, not so close as in *S. bromi*, and almost disappearing near the end of the nepionic period. *Spire short*; whorls  $4\frac{2}{3}$ ; *last half of the penultimate whorl bulging and prominent, widening with great rapidity*. Last  $1\frac{1}{2}$  whorls *densely and evenly malleated throughout*, showing some appearance of spiral sulci, and minutely wrinkled and granulose, the granulation like that of *S. bromi*, becoming much sparser on the last half whorl, and less regularly arranged in spiral lines. Aperture subvertical, acutely ovate, bluish within, the peristome thick, narrowly subreflexed, bright rose colored. Columella concave, roseate. Length 89, diam. 54, longest axis of aperture  $57\frac{1}{2}$  mill.

Brazil: *Rio Grande, Sao Paulo*. Type no. 1119 coll. Museu Paulista.

Well distinguished by the very short spire, bulging penultimate whorl, excessively oblique descent of the last half-turn of the suture, and the even malleation, which is much more pronounced than in *S. bromi*. Though a larger shell, it has the fraction of a whorl less than *bromi*.

*S. AURITUS* (Sowerby). Pl. 23, fig. 97.

Vol. x, p. 26. The specimen here figured differs from those formerly illustrated so much that further exposition is needed. Tested by the key (vol. x, p. 11), it comes to *cantagallanus*. The body-whorl is yellowish-brown with some darker streaks, the spire dark reddish-brown; suture bordered below with a pale band. Surface minutely striolate vertically and everywhere very finely granular. Nepionic shell of  $3\frac{1}{2}$  whorls, sculptured with rather widely-spaced narrow and rather low radial folds, subobsolete toward the latter part of the nepionic period. A contraction marks the beginning of the

post-nepionic growth, which consists of scarcely two whorls. The last whorl is oblong, *much less inflated than in cantagallanus*. The aperture is *very small*, vertical, white-lipped, the peristome rather narrow, the outer lip straightened in the middle and bearing a strong, *long tooth or prominence* on its inner edge. There is a slight lump on the parietal wall. Length 89, diam. 47, longest axis of aperture 49 mill.

The species is probably nearer *cantagallanus* than those with which it is grouped in vol. x. It is less solid and less inflated than the specimens referred to on p. 27 of vol. x, and is completely imperforate, while those are subumbilicate. The specimen figured on pl. 16, f. 26, of vol. x, measures 87, 49, ap. 46 mill.

*S. IHERINGI* (Cless.), *PROCLIVIS* (v. Mart.). Pl. 20, fig. 62.

Vol. x, p. 195. I am unable to decide which of the above names has priority. The figure here given is from a photograph, kindly sent by Dr. von Ihering, of one of the original specimens.

*S. CANTAGALLANUS* (Rang.). Vol. x, p. 22.

Plate, Sitzungs-Bericht Ges. Naturforsch. Freunde zu Berlin, 1896, p. 149, has briefly described the anatomy of this species (under the name *Bulinus proximus*), and of *B. ovatus*.

*S. GRANDIS* (v. Mart.). Vol. x, p. 26.

Dr. von Ihering has obtained specimens of this magnificent species at Ilha Sao Sabastiao, off the coast of Sao Paulo. One before me measures 137 mill. in length.

*S. OBLONGUS* (Müll.). Vol. x, pp. 29, 196.

Bland (Am. Lyc. N. H. of N. Y., vii, p. 360) states that *oblongus* was introduced in Barbados by Mr. Parkinson, from St. Vincent.

New Colombian localities are: *Bouda*, 8 miles southeast from Santa Marta, at 150 ft. elevation (H. H. Smith). *Yequas*, near Honda (Wirt Robinson, A Flying Trip to the Tropics, p. 80, figs.).

Brazil: *Jacobina Mts.*, prov. Bahia (Moricand, 2d Suppl. Mém. Coq. Terr. Bras., p. 45). *Cuyaba* (coll. C. W. Johnson). *Taguara* (Clessin, Mal. Bl. (n. F.), x, p. 167).

Paraguay: Rio Apa, Ascension, San Pedro, etc. (Ancey, Boll. Mus. Zool. ed Anat. Comp., Torino, xii, no. 309, p. 5).

Argentina: Mission of San Francisco, on the upper Pilcomayo.

A variety *minor*, alt. 75–80, diam. 45 mill. was found by Dr. Borelli at San Lorenzo, prov. Jujuy. The shell in these specimens has not the extraordinary thickness of some examples from the La Plata valley and Uruguay, in which the peristome in particular is extraordinarily developed. Entre-Rios prov. (Ancey, t. c., p. 12.)

At Fray Bentos, on the Uruguay river, Dr. W. H. Rush collected the typical large form of *oblongus*, and also a small, obtuse race, solid, with small aperture and brilliantly colored thick peristome, referable to *S. capillaceus intertextus* (*Nautilus* x, p. 78).

Probably *Melania caruatis* PERRY, Conchology, pl. 29, f. 3 is identical with *S. oblongus*.

The following varieties of *S. oblongus* are recognized :

Var. *crassus* Albers. Parana region (Orbigny, Gülich); Concepcion, Uruguay (Lorentz; DOERING, Periodico Zoologico ii, pt. 4, 1877, p. 253).

Var. *alba* Smith. As large as the type, but pure white, lip rose-pink. Pampa Ruis, Bolivia (Orbigny).

Var. *albolabiatu*s Smith. Island of Tobago.

The synonymy of this variety is as follows: *Borus oblongus* var. *albus* Müll., W. G. BINNEY, Ann. N. Y. Acad. Sci. iii, p. 115 (jaw and teeth; shell not described).—*Bulinus oblongus* var. *albolabiatu*s E. A. SMITH, Proc. Malac. Soc. Lond. i, p. 137 (1894).—*Strophocheilus oblongus* var. *tobagoensis* PILSBRY, Man. of Conch. (2 Ser.) x, p. 30, pl. 14, f. 70 (1895).

*S. CAPILLACEUS* var. *INTERTEXTUS* Pilsbry. Vol. x, p. 32.

This variety was taken by Dr. Wm. H. Rush at Fray Bentos, on the Uruguay river, with *S. oblongus*. It is widely separated geographically from *S. capillaceus seneri* (Jonss.), which has a pale peristome.

*S. SANCTEPAULI* v. Iher. & Pils. Pl. 20, fig. 63.

Shell subperforate, much more slender and elongated than *S. oblongus*, not compressed between face and back; with narrow, produced spire. Whorls 6, the earlier ones sculptured as in *S. oblongus*. Substance of the shell reddish, with light subsutural band and ill-defined yellowish basal area; cuticle persistent though very thin; surface costulate as in *S. oblongus*, but the later two whorls have no microscopic granulation. Aperture small, about half the shell's

length, pink within; peristome brilliant rose colored. Length 85, diam. 43 mill.; longest axis of aperture 45 mill.

Brazil: *Botucatu*, Sao Paulo (von Ihering).

*S. oblongus* var. *sunctapauli* v. IHER. & PILS., Proc. Acad. Nat. Sci. Phila. 1900, p. 390 (August 9).

This form has much the contour of *S. santacruzii*, but the early whorls are more swollen and the texture and coloration as in *S. oblongus*. It was described first as a variety of *S. oblongus*, but I agree with Dr. von Ihering that it is entitled to specific rank. The type, no. 71229 coll. A. N. S., is figured.

*S. PARANAGUENSIS* Pils. & v. Iher. Pl. 16, figs. 1, 2.

Shell ovate, *decidedly compressed dorso-ventrally*, moderately solid, *the spire short*, obtuse. Shell substance dull pink, with a pale band below the sutures; cuticle mainly retained on the later two whorls, yellow below the sutures and back of the outer lip, *elsewhere yellowish-chestnut, with rather numerous, narrow, obliquely longitudinal chestnut streaks*. Surface moderately shining, irregularly, *strongly wrinkle-costulate*, as in *S. oblongus*; showing under the lens a microscopic granulation (similar to that of the spire of *S. oblongus*), which is largely or entirely lost on the last half whorl. Nepionic whorls finely costulate, as in *S. oblongus*. Whorls  $5\frac{2}{3}$ , the earlier five regularly and moderately widening, with slightly oblique sutures, the last half whorl (in a dorsal view) rapidly descending, its *suture extremely oblique*. Aperture somewhat oblique, whitish inside; peristome well expanded, brilliant rose-colored; columella with a moderate fold. Length 92, diam. maj. 55, min. 47 mill.; length of aperture 62 mill.

Brazil: *Paranagua*, coast of Prov. Parana.

*S. paranaguensis* PILS. & v. IHER., Proc. Acad. Nat. Sci., Phila., 1900, p. 390, pl. 11, f. 1, 2 (August 9).

With the sculpture of *S. oblongus*, this species unites the contour of *S. ovatus*. It differs from *oblongus* in the streaked cuticle, dorso-ventral compression, short spire, and very oblique last suture. It is more obese than *S. granulatus* Rang, with less pronounced granulation, coarse surface costulation, and closer apical riblets.

*S. GLOBOSUS* (Martens). Vol. X, p. 37.

The locality of this species has hitherto been unknown. It occurs subfossil at Montevideo, Uruguay, whence specimens have been sent



by Dr. von Ihering. It will probably be found living in the same region. The apical sculpture is that of the *S. oblongus* group. Some specimens are so globose as to suggest the European *Helix aspersa*. (*Pils.*, Proc. A. N. S., Phila., 1900, p. 391.)

*S. LORENTZIANUS* (Doering).

Shell subimperforate, ovate, rather solid, somewhat thick, scarcely shining, whitish-fulvous, wrinkle-striate, banded at the suture; apex a little obtuse. Whorls  $5\frac{1}{2}$  to 6, a little convex, the first regularly and closely costulate-striate, the last ventricose, striate-wrinkled, about five-ninths the total length. Aperture ovate-oblong, glossy pale-reddish inside; peristome thickened, narrowly-expanded, a little reflexed, of an intense rose-purple color, the margins joined by a spreading, glossy, rose-purple callus; columellar margin dilated, appressed. (*Doer.*)

Var. *a*. Large, thick; length 95–100, diam. 64–66, aperture with peristome 57–58 mill. long, 42–43 wide.

Var. *b*. Small, ovate-oblong, thin, of an intense fulvous color; length 75, diam. 45, apert. with perist. 42 mill. long, 33 wide.

Argentina: *Sierras of Tucuman, Salta and Jujuy* (Lorentz, Hieronymus and Stelzner).

*Borus lorentzianus* DOER., Periodico Zoologico ii, pt. 4, p. 255 (1877).

This species differs from *S. ovatus* by the slightly reflexed peristome, subsolute in periphery, and the intense rose-purple callus; from *S. oblongus* by the more swollen shell, more obtuse apex, slightly reflexed peristome and whitish-zoned suture; from *S. bromii* by the sculpture, purple callus and folded columella; from *S. capillaceus* by the sculpture and whitish-bordered suture. The var. minor is found in company with the large specimens, and as no intermediate forms have been received, it may be a distinct species.

This species is known to me by the above description only. It seems to belong to the *S. oblongus* group, and is probably related to *S. paranaguensis*.

*S. LUTESCENS* (King). Vol. x, p. 36.

Var. *cordilleræ* Doering. Shell ovate, intense buff, obsoletely striate, rather smooth; suture suberemulate; peristome narrowly reflexed, of an intense orange color. Length 38, diam. 25, length of aperture with peristome 20, width 15 mill. (*Doer.*).

Argentina: *Sierra de Cordova*, extremely rare (Doering).

*Borus lutescens* var. *cordilleræ* DOER., Periodico Zoologico ii, pt. 4, 1877, p. 254.

The spiral lines of the typical form are wanting, or very weak on the first whorls only, and the peristome is a bright orange-rose color throughout.

Var. *dorbignyi* (Doering). Pl. 24, fig. 1.

This is var. *australis* Martens (vol. x, p. 36). I do not know which name has priority. Doering mentions a large form, "var. *maxima*," length 35, width 23, and a small, "var. *minima*," length 30, width 20 mill.

*Bahia Blanca* (Orb., Strobel, U. S. F. C.); *Rio Sance* (Chico) (Roca Exped.); *interior of Patagonia* (Moreno).

*Borus dorbignyi* DOER., Bol. Acad. Cienc. Cord. ii, p. 336; Periodico Zoologico ii, pt. 4, p. 255 (1877); Informe Oficial de la Comision Cientifica agregada al estado mayor general de la Expedition al Rio Negro, Roca, pt. 1, Zool., p. 64, pl. 1, f. 4 (1881).

S. CRENULATUS (Pfr.).

*Bulimus (Borus) credulatus* Pfr., NEVILL, Handlist Moll. Ind. Mus. i, p. 121, is a synonym.

Subgenus THAUMASTUS Alb. (Vol. x, p. 43).

S. GRANOCINCTUS n. n.

Shell large, perforate, ovate-oblong, solid, brownish-black, ornamented with a brown band below the suture, scarcely shining, spire conic with the outlines a trifle convex, apex obtuse, whitish, smooth; suture somewhat irregular, finely crenulated below, narrowly margined with whitish. Whorls 7, regularly increasing, the upper rather flattened, striatulate, more distinctly so below the sutures; from the antepenultimate down they are more convex, roughly striate, the striae more distinct below the suture, encircled throughout with wide, flat liræ, wider than their interstices, which are peculiarly granose-sealy. Last whorl long, behind measuring three-fifths the length of the shell, the base compressed around the perforation; anteriorly strongly descending for a long distance, then shortly ascending. Aperture ovate, subvertical, deeply excised by the penult. whorl, livid leaden-brown with a blackish border, and with a silky or pearly lustre within. Peristome thickened, livid lead-brown, the margins remote, connected by a thick, translucent callus, lead-brown outwardly; outer lip subangular above, then slightly pro-

duced, nearly straight, expanded but scarcely reflexed; basal lip compressed, rounded, somewhat effuse; columellar margin short, thick, reflexed above the perforation, dilated at the insertion, and entering in a thick fold. Length 94, diam. 50, oblique length of aperture 51, width 34 mill. (*Rolle*).

Peru: *Chauchanoyo*.

*Bulinus (Dryptus) filocinctus* ROLLE, Nachr. d. D. Malak. Ges. 1901, p. 93 (June 11, 1901). Not *Bulinus filocinctus* Reuss, Sitzungsber. der K. Akad. Wissensch. Wien, xlii, Jahrg. 1860, p. 69 (1861).

Intermediate between *foreolatus* Reeve and *melanocheilus* Nyst, but differing from both in sculpture. Between the rather wide, almost girdle-like spiral cords on the last two whorls, the growth-striae swell into flat, oval knots, which project above the level of the girdles and are more noticeable than the latter. They appear to be hollow. Below they appear simply as short, projecting riblets. The first  $2\frac{1}{2}$  whorls have a peculiar fine granular-wrinkled minute sculpture. The coloration most resembles that of *melanocheilus*.

It is evidently a member of the group of *S. melanocheilus*, and perhaps most nearly allied to *S. saugoe* (vol. x, p. 45).

*S. BITENIATUS* (Nyst). Vol. x, p. 58.

Specimens from Perene, Peru, are rougher than indicated by the figures of this species, with more convex whorls, and narrower upper light band, which is separated from the suture by a dark band. Probably *B. jelskii* Lub. and *abutaceus* Rve. are merely varying forms of *biteniatus*.

#### Genus PLEKOCHEILUS Guilding.

*P. GIBBONIUS* (Lea). Vol. x, p. 75.

Another synonym is *B. gibboreus* Pfr.-Cless., Nomencl. Hel. Viv., p. 227.

*P. MABILLEI* (Crosse). Vol. x, p. 79.

Prof. v. Martens records a larger variety with wider lip,  $32\frac{1}{2}$  mill. long,  $16\frac{1}{2}$  wide, mouth 19 long, from the road toward the Llanos from San Martin, Colombia, collected by Stübel (Conch. Mittheil., p. 158).

*P. SUBGLANDIFORMIS* (Mouss.). Vol. x, p. 80.

Dohrn (Jahrb. ii, p. 305) finds that it varies notably in size, between length 38, diam. 18, apert. 20 mill. and 30, 15, 17 mill.

*P. SUCCINOIDES* (Pfr.). Vol. x, p. 84.

Neighborhood of Muzo 600–800 meters elev., and on the way from Bogotá to Ibaguë, Colombia (Stübel, Conch. Mittheil., p. 158).

*P. ARGENTEUS* (Jousseaume). Pl. 21, fig. 70, 71.

Shell imperforate, ovate, rather solid, most minutely granulate, plicate-crenulate at the suture; tawny, ornamented with scattered chestnut dots and a few whitish streaks. Spire conic, a little obtuse. Whorls  $4\frac{1}{2}$ , slightly convex. Aperture oval, glossy within with scattered chestnut dots; columella reflexed, slightly arcuate; peristome thickened, reddish, moderately expanded throughout. Length 21–25, diam. 9–12, length of aperture 9–15 mill. (*Jouss*).

*Merida, Venezuela*, at 4000 meters elevation.

*Euritus argenteus* JOUSS., Bull. Soc. Philomathique de Paris (9 ser.), ii, p. 41, pl. 1, f. 20, 21 (1900).

In general characters this species resembles *B. veranyi* Pfr., but it is smaller and more globose, without an umbilical perforation; the lip is of a bright rose color, and there are short folds below the suture.

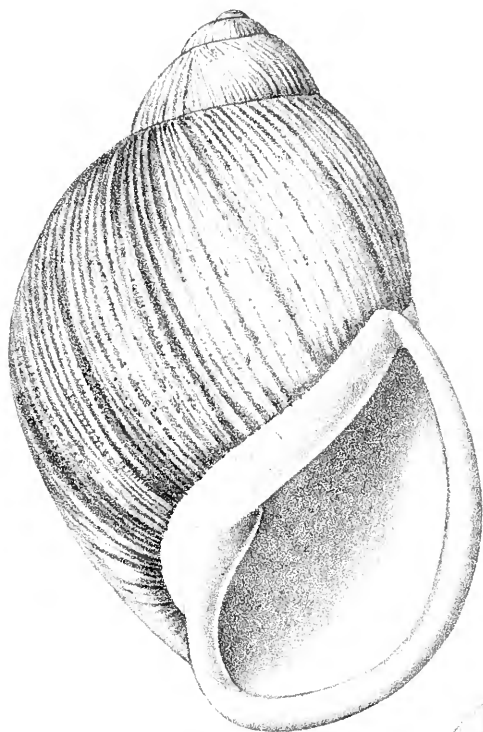
*P. DALMASI* Dautzenberg. Pl. 21, figs. 72, 73.

Shell imperforate, ovate, thin and subpellucid, whorls  $4\frac{1}{2}$ , convex, separated by an impressed and irregularly crenulate suture, the first whorl very delicately decussate, the rest shining and ornamented with irregular growth-wrinkles. Spire short and obtuse. Last whorl very large, descending in front. Aperture oval; columella narrow, arcuate, a little twisted above; lip narrowly margined and almost reflexed; the margins joined by a very thin, translucent callus. Color dark-brownish corneous, the suture narrowly white or yellow-margined; peristome rose white. Length 26, diam. 16, aperture with peristome  $16\frac{1}{2}$  mill. long, 11 wide (*Dautz.*).

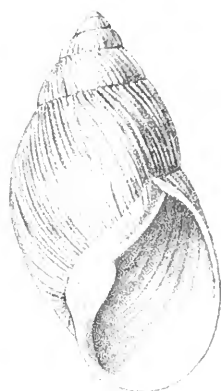
*Plecochilus dalmasi* DAUTZ., Mém. Soc. Zool. de France for 1900, xiii, p. 151; *Plekocheilus dalmasi* DAUTZ., t. c., pl. 9, f. 1, 1.

Remarkable for its small size, quite oval form with short spire, thin shell, the narrow margin of the peristome, and for the uniform color, without spots or flames.

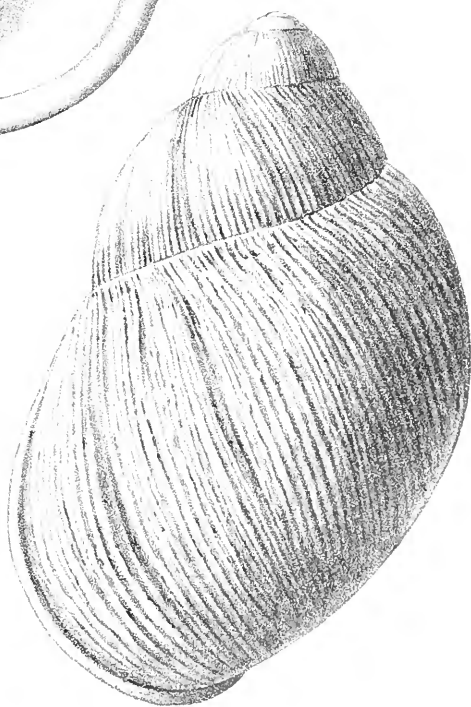
The locality is not stated by Mr. Dautzenberg, but Count R. de Dalmas collected in several Caribbean islands, in Venezuela at Yacua, and in the Sierra de Sta. Marta. Probably this is from the latter locality.



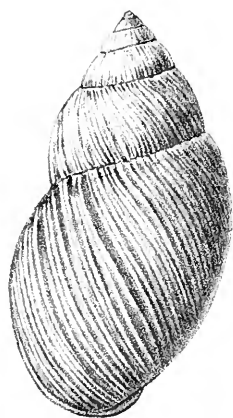
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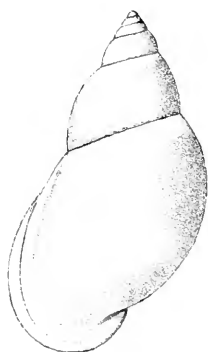


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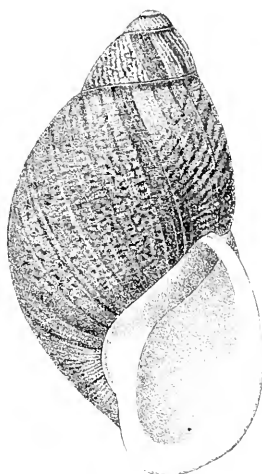
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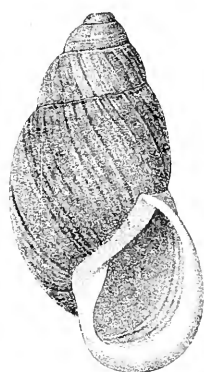
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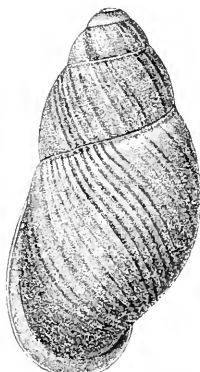
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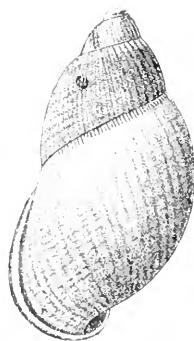
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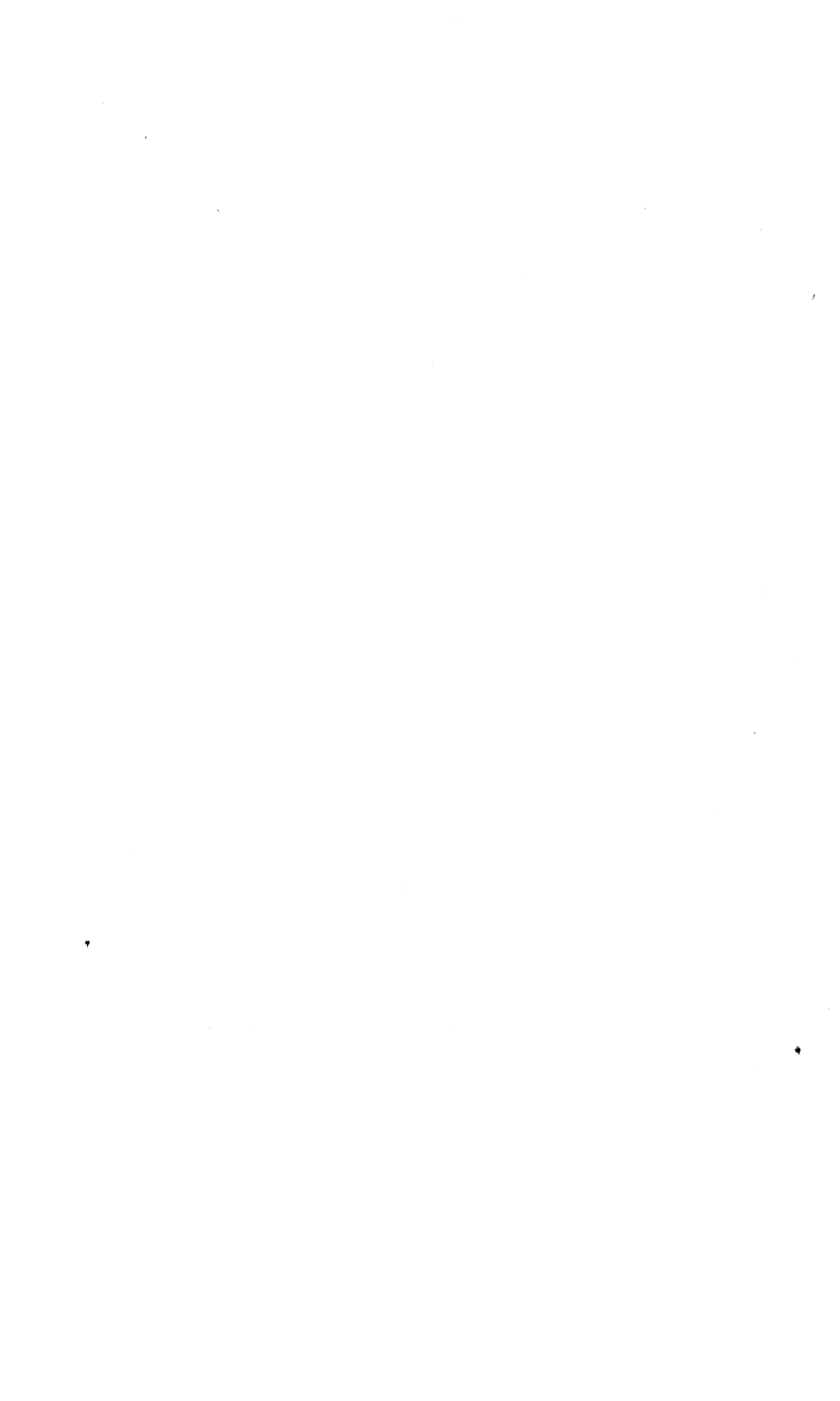
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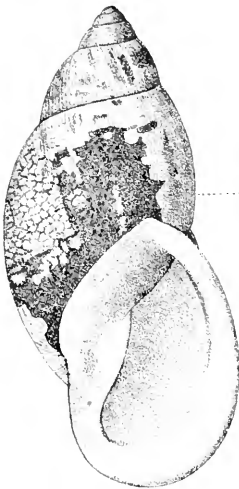
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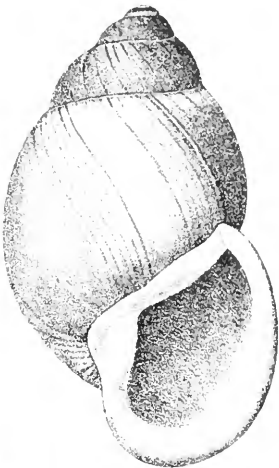




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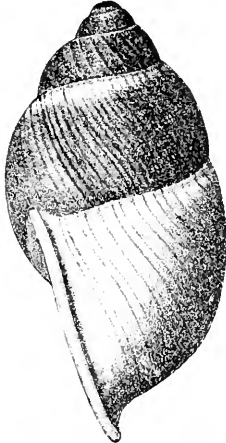
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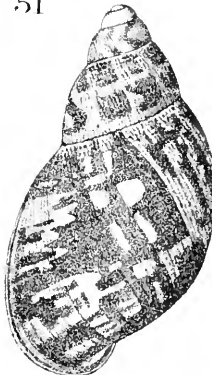
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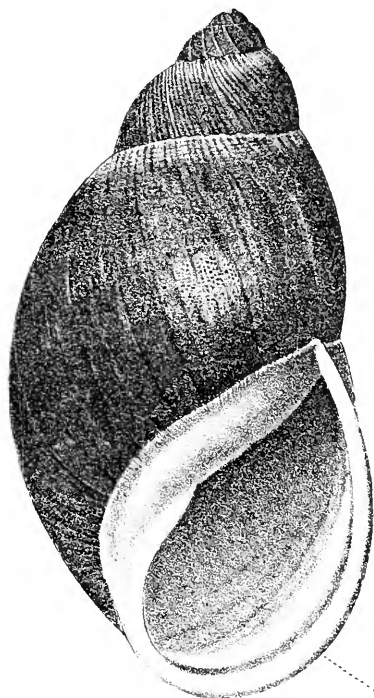


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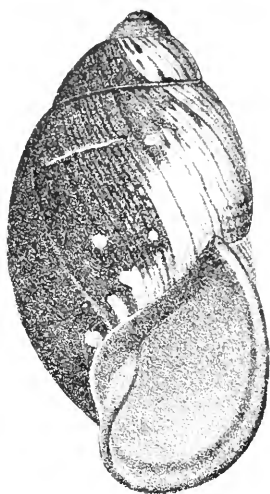


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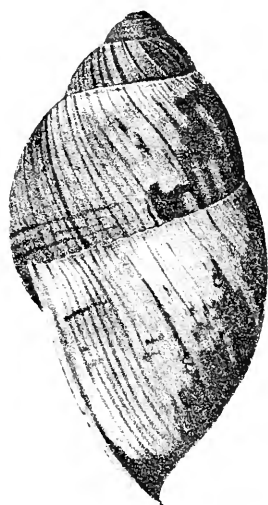




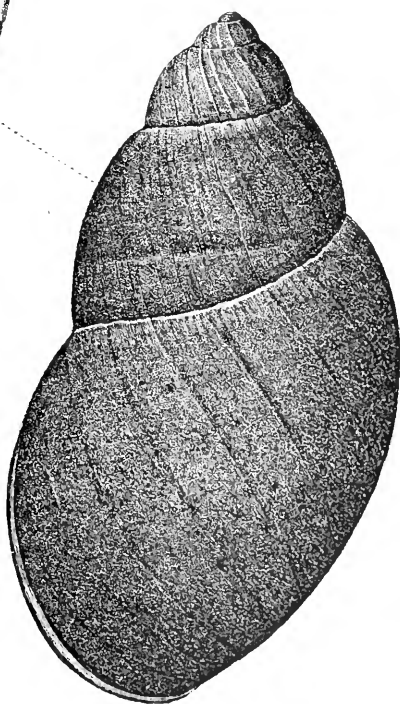
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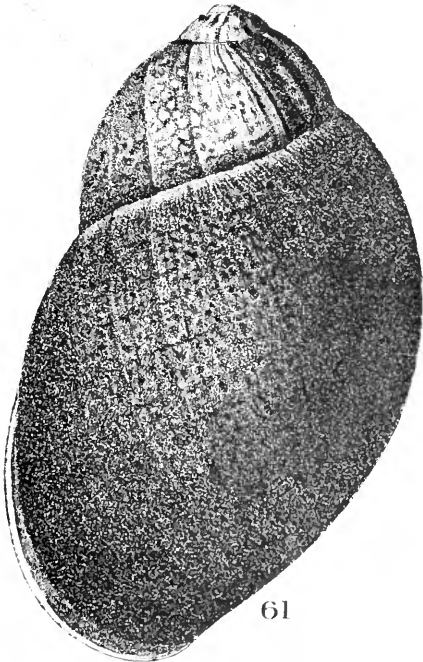
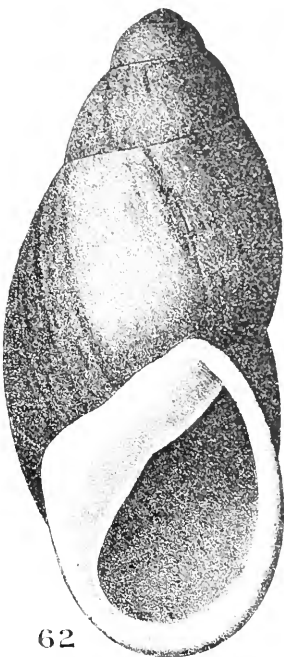
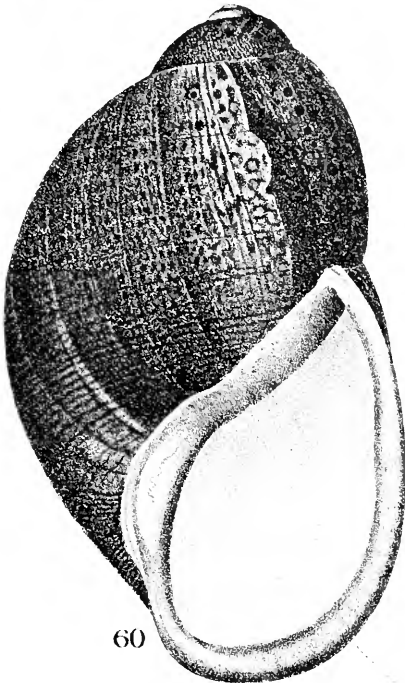


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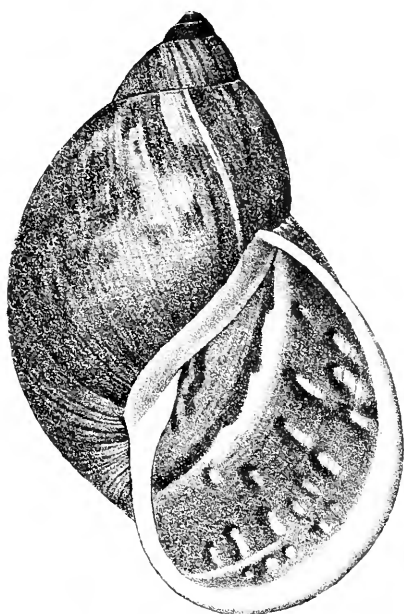


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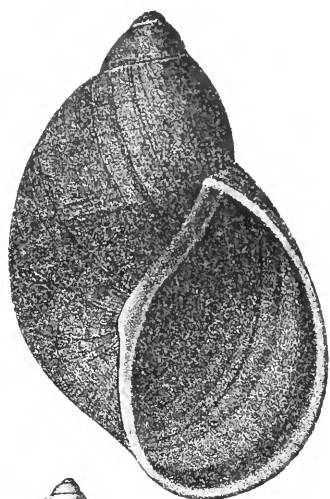








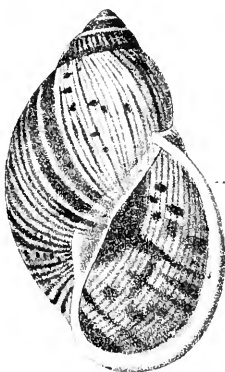
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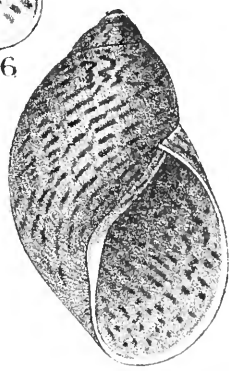
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*P. PLECTOSTYLUS* (Pfr.). Vol. x, p. 70.

Road from Popayan to Coconuco, on the Altura de los Pesares, 2400–2600 meters elevation, and on the road from Popayan to Patia, at about 1500 meters (Stübel, v. Mart., Conch. Mittheil., p. 158).

*P. GULDINGI* (Dohrn) = *P. GUENTHERI* (Sowb.). Vol. x, p. 71.

The name was pre-occupied by Pfeiffer, Symbolæ ii, p. 115 (1842), and will be suppressed in favor of *P. GUENTHERI* Sowb.

*P. COLORATUS* (Nyst). Vol. x, p. 74. Pl. 21, fig. 64.

In Colombia, Department of Santa Marta, this species was found by Mr. Herbert H. Smith (1898–1901) from 800 to 6000 ft. above sea level. Size and coloration vary widely, the largest and thinnest examples occurring at the higher altitudes. Mr. G. H. Clapp has supplied the following notes on the specimens from various localities, all of which lie to the east and southeast of Santa Marta.

Calavase Road, 8 miles east of Bonda, 800 ft. elevation. Alt. 57, diam. 38; aperture, alt.  $38\frac{1}{2}$  mill. (This was the only living shell found so low down.)

Campo Alegre, about 1500 ft. elevation.  $67\frac{1}{2} \times 42$ ; apert. 44 mill.

Minca at 2000 ft. elevation. (a)  $46\frac{1}{2} \times 28$ ; apert.  $30\frac{1}{2}$ . (b)  $51 \times 32$ ; apert.  $33\frac{1}{2}$ . (c)  $56\frac{1}{2} \times 36$ ; apert.  $36\frac{1}{2}$ . (d)  $61\frac{1}{2} \times 39\frac{1}{2}$ ; apert.  $39\frac{1}{2}$ . These four shells show a wide variation in color and thickness. Specimen "a" is thin and dark-colored, the dark spots being more or less confluent and arranged in streaks. "b" is very thin and light-colored, the spots being widely scattered on the body whorl and arranged in zigzag streaks on the penultimate. "c" is very heavy and dark-colored, the markings are arranged in alternate dark and light streaks which are irregular, the light streaks being spotted with brown. "d" somewhat thinner than "c" and the color pattern is exactly like pl. 32, fig. 42, of vol. x.

Don Amo, 2000 ft. elevation.  $63 \times 38\frac{1}{2}$ ; apert. 40 mill.

Above Minca about 2500 ft.  $76\frac{1}{2} \times 50$ ; apert. 52 mill.

Onaca, 2500 ft.  $89 \times 55\frac{1}{2}$ ; apert. 59 mill.

Jiracasaca. Clearing at about 2500 ft.  $59 \times 36$ ; apert.  $37\frac{1}{2}$  mill.

Jiracasaca, 2800 ft.  $64\frac{1}{2} \times 39$ ; apert.  $40\frac{1}{2}$ . This is a straw-colored shell without any trace of brown spots on the body-whorl and with a few very faint brown zigzag markings on the spire. This is a quite distinct color-form.

Above Aqua Dulce, 3000 ft.  $67 \times 42\frac{1}{2}$ ; apert. 46 mill.

Don Amo Estate, 3500 ft.  $65 \times 41\frac{1}{2}$ ; apert.  $40\frac{1}{2}$  mill.

Las Partidas, 3500–3800 ft. (a)  $48\frac{1}{2} \times 30$ ; apert.  $30\frac{1}{2}$ . (b)  $54\frac{1}{2} \times 34\frac{1}{2}$ ; apert. 34. (c)  $70\frac{1}{2} \times 45$ ; apert. 46 mill.

Onaca Estate, 4500 ft. (a)  $74 \times 46\frac{1}{2}$ ; apert.  $47\frac{1}{2}$ . (b)  $74 \times 49$ ; apert.  $48\frac{1}{2}$ .

Valparaiso, 4500 ft.  $82 \times 56$ ; apert.  $56\frac{1}{2}$  mill.

El Libano, 6000 ft. (a)  $83\frac{1}{2} \times 53$ ; apert. 53. (b)  $77\frac{1}{2} \times 53$ ; apert.  $51\frac{1}{2}$ . (c)  $86 \times 58$ ; apert. 59. (d)  $92 \times 59$ ; apert. 60 mill. See pl. 21, fig. 64.

These specimens are larger than those from lesser altitudes. They are quite thin, with indistinct, mottled pattern, densely and minutely sprinkled with yellow dots, the granules being mainly of that tint. The peristome is pink. They are as large as var. *ampullaroides* (Mouss.) or larger, but differ from that form in the sloping or tapering upper portion of the whorls, which is not swollen as in Mousson's variety.

According to Mr. Smith, *P. coloratus* is found on the ground among dry leaves and they are very hard to find an account of their assimilating color.

Var. *subplicatus* Pfr. (vol. x, p. 198, 199) is evidently close to the form of *coloratus* found in the Santa Marta range. Figures are here given (pl. 21, figs. 67, 68), copied from Pfeiffer.

I have little confidence in the records of *P. coloratus* from Ecuador.

*P. DOLIARIUS* (Da Costa). Pl. 24, fig. 5.

Shell ovate, umbilicate, somewhat thick, exceedingly ventricose. Whorls 5, minutely granulated throughout, transversely very closely striate, the striæ rugose and minutely undulating, delicately plicate at the sutures; last whorl very ample, inflated, obliquely descending. Columella somewhat twisted, callous above; lip reflexed. Smoky chestnut, the aperture and peristome purplish-lilac. Length 58, diam. 41 mill.; aperture 40 mill. long. 26 wide (*Da Costa*).

*Paramba, Ecuador.*

*Strophocheilus (Eurytus) doliarius* DA COSTA, Proc. Malac. Soc. London, iii, p. 84, fig. I (July, 1898).

This shell, while it approaches both *gibbonius* Lea and *castaneus* Pfr., differs from them in form and sculpture.

*P. COUTURESII* (Ancey).

Shell ovate, rather thin, subimperforate, a little shining; dull purple under a thin, more or less deciduous green or buff-brown epidermis. Spire short, obtuse, the apex brown-purple, rounded-subconoid at summit. Whorls 4, rapidly increasing, a little convex, the suture impressed, marked with growth striae and minutely granulate: the penultimate whorl somewhat swollen on the right side; last whorl deflexed beyond the middle for a long distance, malleate and very minutely granulose, the striae forming slight folds at the suture. Aperture almost vertical, irregularly oval, angular above, the columellar fold calloused, inside livid purple; peristome revolute and thickened throughout, rose-purple, the margins joined by a glossy parietal callus, columellar margin a little dilated at the insertion. Length 38, diam. 22, alt. of aperture with peristome 22 mill. (*Ancey*).

*Bolivia* (teste G. Coutures).

*Eurytus couturesi* ANC., *The Nautilus*, xiv, p. 42 (August 1, 1900).

"This is more egg shaped than either *E. pulicarius* or *E. catheartiae* Reeve, which seem to be its immediate allies. In form it resembles *E. cardinalis*, Pfr., from Quito, but is a smaller and much thinner shell. I have seen two specimens precisely alike, differing only in size, the larger one, the type, is in my collection" (*Ancey*).

*P. CASTANEUS* (Pfr.). Vol. x, p. 85. Pl. 21, fig. 65.

A rather narrower form is here figured. It is of a very dark color, black-brown slightly olive tinted, the aperture purple-black with a pearly sheen. It is from Cauca, Colombia, and measures, length 64, diam. 39, longest axis of aperture 42 mill.

*P. TRICOLOR* (Pfr.). Vol. x, p. 87. Pl. 21, fig. 69.

A large form is here figured, measuring: length 47, diam. 28, longest axis of aperture 30 mill., whorls  $4\frac{1}{3}$ .

This species belongs to the "group of *P. taylorianus*," and differs from the species tabulated on p. 89 of Vol. x, in its more elaborate color-pattern. Cousin has bungled characteristically in his synonymy of *tricolor* (Bull. Soc. Zool. France, xii, 209). The variety *semipictus* Hid. (vol. x, p. 87) was taken by him at Pahuja, Ecuador. *Simpulopsis fulgurata* Miller (see vol. xii, p. 227) is probably a young specimen of this species.

*P. PIPERATOIDES* Pilsbry, n. sp. Pl. 21, fig. 66.

Shell imperforate, ovate with conic spire, thin; whitish-corneous, profusely dappled with chestnut-brown; the first whorl brown, shallowly and minutely sculptured with waved wrinkles; apex obtuse. Whorls  $4\frac{2}{3}$ , slightly convex, regularly and slowly increasing, the last whorl long-oval; surface irregularly and rather closely and finely wrinkled or plicatulate, without spiral lines. Suture impressed, the last third of a whorl rapidly descending. Aperture symmetrically ovate, acute above, quite oblique, whitish and spotted within; peristome white, the edge very narrowly expanded, the basal and columellar margins evenly arcuate, outer lip only feebly arcuate above. Length 29, diam.  $17\frac{1}{2}$ , longest axis of aperture 18 mill.

*Colombia.*

Smaller than *P. piperitus*, without spiral sculpture or the peppering of small dots, and having the outer lip much less arcuate above.

*P. PIPERITUS* (Sowb.). Vol. x, p. 89.

The reference to Reeve should read "*B. piperatus*." According to Pfeiffer (Nomenclator Hel. Viv. p. 227), *Plectostylus pulicarius* Beck is identical. It is a nude name.

*P. TAYLORIANUS* (Reeve). Vol. x, p. 90.

Reported from Nanegal, Ecuador, by von Martens, from specimens collected by Stübel (C. Mittheil., p. 158).

Genus *AURIS* Spix (Vol. x, p. 95).

Mr. S. Pace, in Proc. Malac. Soc. Lond. i, p. 151, has described and figured the anatomy of *A. aurisscinni*, a species of the section *Eudolichotis*.

*A. ICTEROSTOMA* (von Martens).

Shell perforate, subglobose-conic, rather solid, striatulate, yellowish-white, ornamented with repeated pale brown, waved streaks, and three narrow violet-brown spiral bands. Whorls  $5\frac{1}{2}$ , rather convex, the first smooth, white, the last rather swollen, rounded, more distinctly rib-striate towards the base. Aperture ear-shaped, the peristome reflexed, bright yellow, outer lip narrow above, widely expanded below; basal margin rounded, with a tooth-like callus at the insertion of the columellar margin, the latter being twisted inwardly, broadly and triangularly expanded outwardly; parietal wall covered

with a very thin callus, not modifying the external coloring. Throat pallidly showing the streaks and bands through. Length 35, diam. 23, aperture including peristome 22 long, 19 wide; excluding peristome  $16 \times 10\frac{1}{2}$  mill. (*v. Mart.*)

Eastern Peru: *Valley of the Urubamba*, one of the upper tributaries of the Amazon. (Staudinger.)

*Bulinus icterostomus* v. MART., Nachr. d. D. Malak. Ges., xxxiii, p. 149 (October, 1901).

"This handsome species agrees well with *B. melastomus* Swains., in the structure of the aperture, the general contour, and partially in the coloring, and might at first sight be taken for a small, yellow-mouthed variety of that species; but the absence of sculpture on the upper whorls, the total want of black at the aperture, and the geographic separation, all tell against such a view. *B. melastomus* with its varieties occurs to my knowledge only in the provinces of Bahia and Illheos." (*v. Martens*).

A. GLABRA (Gmel.). Vol. x, p. 114.

Figured as *Bulla s. Voluta auris Judæ* by MEUSCHEN in Gronovius' Zoophylacium iii, expl. of pl. v, pl. 18, f. 12 (1781).

#### Subgenus GONYOSTOMUS Beck.

A. TURNIX (Gould). Pl. 18, figs. 53, 54, 55.

Shell deeply rimate, long-ovate, *copiously blotched and marbled with white and brown on a pale ground*, the white blotches somewhat arranged in spiral bands, the brown forming interrupted wide longitudinal streaks. Surface slightly glossy, closely plicatulate longitudinally, *the wrinkles cut into granules* by spiral impressed lines; the granulation much more conspicuous below the suture and at the base. Spire conic, the apex very obtuse, as though truncate. Whorls nearly 5, convex, the last rather swollen, full and convex beneath. Aperture oblong, vertical, variegated within; peristome narrowly expanded and reflexed, orange colored. Columella with an oblique, straight fold within. Length 48, diam. 25, longest axis of aperture 29 mill.

Brazil: *Organ Mts.* (Gld.); *Serra da Bocaina*, prov. S. Paulo (von Ihering).

*Bulinus turnix* GLD., Proc. Bost. Soc. Nat. Hist., ii, 1846, p. 101; Otia, p. 199.—PFR., Monogr., iii, p. 315; iv, 395.

The variegated color-pattern differs from that of *A. multicolor* in detail. The sculpture shows *A. turnix* to be related to *A. hybridus*, a species with carinate base. The specimen described was received from Dr. v. Ihering. Gould's type measured: length  $2\frac{1}{2}$ , diam.  $1\frac{1}{10} \times 1\frac{9}{10}$ , aperture  $1\frac{8}{10}$  inches, (about 55 mill. long,  $27\frac{1}{2}$  wide, with the aperture  $32\frac{1}{2}$  mill. long). Gould describes the lip as strongly revolute and roseate.

A specimen in the American Museum of Natural History, Central Park, New York (No. 5148a), measures: length 50, diam.  $27\frac{1}{2}$ , longest axis of aperture  $32\frac{1}{2}$  mill. The lip is rather broadly reflexed and *white*. Cuticle yellow, showing the usual brown and white markings (fig. 53). It is from the Organ Mts.

#### Genus XENOTHAUMA Fulton, 1896.

FULTON, Ann. and Mag. N. H. (vi), xviii, p. 102 (July, 1896).  
—CROSSE, Journ. de Conchyl. 1898, p. 205.

Shell broadly umbilicate, depressed and keeled, heliciform, chalky, opaque and spirally striate, the nepionic whorl projecting, sculptured with much-dislocated vermiculate wrinkles; last whorl deeply descending, free in front, the aperture subhorizontal with continuous, broadly flaring peristome, reflexed below.

An extraordinary form, the position of which can be settled only by investigation of the soft anatomy. Mr. Fulton thought it might be near *Epiphragmophora*. Crosse also considered it a "Helix," which he would group with *H. reentsi* Phil. (*Platybostryx*). In my opinion *Xenothauma* is Bulimulid, and has been modified from the Peruvian group of *Scutalus* of which *B. baroni*, *B. steerei*, etc., are typical members. It is parallel with, but not related to, *Platybostryx*, which has diverged from the Chilean *Lissoacme* type of *Bulimulus*.

X. BARONI (Fulton). Pl. 24, figs. 6, 7, 8, 9, 10.

Shell depressed, lens-shaped, orbicular in circumference, acutely carinate, with a wide, conic umbilicus; calcareous, lustreless, rusty brown. Sculpture of numerous narrow and rather acute spiral cords running over rough, irregular growth-striae, the cords larger beneath. Whorls  $4\frac{1}{2}$ , the first one projecting, the earlier  $1\frac{2}{3}$  forming a wrinkled nepionic shell; subsequent whorls but slightly convex, the last pinched out in a compressed, thin peripheral keel, deeply descending and becoming free in front, convex beneath, carinate around the

umbilicus. Aperture subhorizontal, rounded-triangular, brownish inside; peristome broadly flaring, continuous, pale at the edge, brown within, the basal and columellar margins reflexed, a deep, narrow groove entering from the position of the keel.

Alt. 12, diam. 30 mill. (type).

Alt. 11, diam. 28 mill.

Peru: *Rio Yonan*, at 4000 ft. elevation (C. T. Baron).

*Helix (Xenothauma) baroni* FULT., Ann. Mag. N. H. (6), xviii, p. 101 (July, 1896); xx, pl. 6, f. 7, 7a (Aug., 1897).—CROSSE, Journ. de Conchyl. xlv, 1898, p. 206, pl. 10, f. 1.

The general resemblance of this species to the Madeiran *Geomitra delphinula* Lwe., and the European and North African *Helix gualteriana* L., *viola* Ponsonby, and *sultana* Morelet, has been commented on by Mr. Fulton. In South America it has most resemblance to *Bulimulus (Platybostryx) eremothauma* Pils., as Crosse has remarked.

## Genus BULIMULUS Leach.

### Section *Peronæus* Alb.

B. BAERI (Dautzenberg). Pl. 48, figs. 41, 42.

Shell rather solid, lengthened, turreted, narrowly rimate. Whorls 11, little convex, separated by an impressed suture, the first smooth, the rest ornamented with oblique longitudinal riblets, more irregular and lower on the last whorl. Aperture small, the margins hardly converging. Columella a little straightened, slightly reflexed; outer lip simple, acute. Color blue-white, marked with very irregular brown longitudinal streaks, the upper whorls corneous and subtranslucent; umbilical chink bordered with brown; peristome white, the columella brown tinted, throat fulvous. Length  $14\frac{1}{2}$ , width  $3\frac{1}{2}$  mill.; aperture  $3\frac{1}{4}$  mill. long,  $2\frac{1}{2}$  wide (Dautz.)

Peru: *Iocos* (M. Baer).

*Peronæus baeri* DAUTZ., Journ. de Conchyl. xlix, p. 131 (July, 1901); p. 214, pl. 8, f. 3, 4.

B. IOCOSENSIS (Dautzenberg). Pl. 48, figs. 43, 44.

Shell not very solid, long-turreted, shortly and very narrowly rimate, the spire with attenuated apex. Whorls 11, little convex, separated by an impressed suture, the first smooth, the rest ornamented with longitudinal, arcuate, irregular, remote, waved and granulose

ribs. Aperture small, its margins scarcely converging. Columella straight and a little reflexed; lip simple and acute. Color pale fulvous, irregularly ornamented with brownish longitudinal spots and streaks; becoming blackish towards the apex. Length 13, width 3 mill.; aperture 3 mill. high, 2 wide (*Dautz*).

Peru: *Icos* (Baer).

*Peronaeus icosensis* DAUTZ., J. de C. xlix, p. 131 (July, 1901); p. 213, pl. 8, f. 1, 2.

Section *Ataxus* (Vol. x, p. 130).

B. MONIEZI Dautzenberg. Pl. 23, figs. 98, 99, 1, 2.

Shell not very solid, rather shining, broadly and deeply umbilicate. Spire long-conic, attenuated towards the apex. Whorls 9-11, slightly convex, separated by impressed sutures; the first 2 whorls smooth, the rest longitudinally, obliquely, elegantly costulate, there being about 35 riblets on the penultimate whorl. Last whorl becoming more or less free towards the aperture. Umbilicus pervious, acutely margined. Aperture long-ovate, subangulate above and below, compressed on both sides; peristome continuous, acutely margined, the inner lip a little reflexed. Color whitish ornamented with two brown bands; apex violet-brown. Length 14, width  $6\frac{1}{2}$ , aperture 4 mill. high,  $2\frac{1}{2}$  wide (*Dautz*).

Andean region of Peru.

*Bulimulus (Bostryx) moniezi* DAUTZENB., Journ. de Conchyl. 1896, p. 224, pl. 7, f. 3.

A color-form *albescens* (figs. 98, 99) is whitish without bands, but retaining the dark apex.

It varies in the degree to which the last whorl becomes free. *B. holostoma* Pfr. is a smaller shell, with more deeply constricting sutures and short aperture. *B. moniezi* seems closely related to *B. tubulatus* Morel. (vol. x, p. 132).

Section *Lissoacme* Pils. (Vol. x, p. 154).

B. DEPSTUS (Reeve). Pl. 23, figs. 94, 95, 96.

Vol. 10, p. 181. The original type of this species was a small dark-colored specimen. A large series collected by Prof. Steere and others taken at Cajabamba, Peru, by Baron, show that the species I defined as *B. flagellatus* (Manual x, p. 166) is an elongated form of the same species.



It varies widely in color and shape, as the figures here given show; but always has *conspicuously convex whorls*. The interior and columella may be purplish-brown, ochre, or rarely white. Specimens measure: Length  $21\frac{1}{2}$ , diam. 12 mill.;  $22\frac{1}{2}$ ,  $10\frac{1}{2}$ ; 24,  $9\frac{1}{2}$  mill.

A series of 7 shells labeled "Titicaca (A. Agassiz)," are white or with but few streaks, otherwise agreeing completely with those from Balsas.

*B. EXORNATUS* (Reeve). Vol. x, p. 171.

Ancey reports specimens from the Andes of Bolivia east of Lake Titicaca, in the Province of La Paz (Le Nat., 1901, p. 93).

*B. NIGROPILEATUS* (Reeve). Pl. 23, figs. 86-92.

Vol. x, p. 182. The type was a rather small specimen with black apex and a subperipheral interrupted band. A wide range of variation is shown in a large series taken by Baron at Cajabamba, Peru (8000 ft. elev.), and others collected by Steere, exact locality not noted.

The shell may be either white, uniform or with an interrupted or continuous belt below the periphery, or have additional bands and lines, or there may be brown streaks in addition to the spiral bands, or streaks only may be present. In any of the patterns the apex varies from intense black to pale brown, corneous or translucent white. The whorls are much less convex than in *B. depstus*. The interior and columella vary from fleshy-brown to a fleshy-ochre tint, and are rarely almost white. Figs. 86, 87, 88, 92 are specimens from Cajabamba; figs. 89, 90, 91 from the Steere collection.

*B. stenacme* Pfr. (Vol. x, p. 182) seems to me to be merely a form of *nigropileatus*. An unusually long specimen from Cajabamba is illustrated, pl. 23, fig. 93.

*B. radiatus* Morelet (not Brug.; renamed *B. angrandianus* Pils., Proc. Acad. Nat. Sci. Phila. 1897, p. 19), *B. orophilus* and *B. balsanus* of Morelet, and *B. reconditus* Reeve, do not seem to differ materially from *B. nigropileatus*, and probably are merely local variations of a wide-spread species.

*B. SIMPLICULUS* (Pfr.). Vol. x, p. 176.

Specimens received from Messrs. Sowerby & Fulton under this name do not differ from *pruinus* Sowb. Pfeiffer's type has not

been figured, but the description offers little to differentiate it from *pruinus* except the somewhat greater size.

B. DENDRITIS Morel., vol. x, p. 186, is probably a *Drymæus*.

B. VENTANENSIS Pils. Vol. x, p. 189.

This is evidently close to some forms of *B. mendozanus*, but it does not seem to be identical, so far as I can tell from the published descriptions.

B. APODEMETES (Orbigny). Vol. x, p. 187.

Dr. Borelli collected this species at Tala, prov. Salta, Argentina; San Lorenzo, Prov. Jujuy, and Caiza, in the Chaco, Bolivia (*Ancey*, Boll. Mus. Zool. ed Anat. Comp. Torino, xii, No. 309, pp. 5, 14).

B. HELOICUS (Orb.). Vol. x, p. 193.

The original locality was the Mission de Bibosi, Prov. Santa Cruz de la Sierra. *Ancey* reports a variety from San Lorenzo, in the Province of Jujuy (Dr. Borelli). He compares it with *B. sporadicus* (*Ancey*, l. c. p. 15).

The same author states that *B. heloicus* is abundant around Gualaguaychu, Province of Entre-rios, Argentina (collected by L. De Vries). It is evidently closely related to *B. sporadicus*, and may only with difficulty be distinguished from some of the varieties of that species. It varies in form, size and color, usually being grayish white with some more or less distinct brown streaks; sometimes it is entirely of a dark reddish-brown color (var. *fusca*). The proportions of aperture and spire vary with the shape, which may be more or less swollen; specimens measuring:

Length 23, diam. 11, length of aperture  $12\frac{1}{2}$  mill.

Length 31, diam. 13, length of aperture  $13\frac{1}{2}$  mill.

Length  $25\frac{1}{2}$ , diam.  $13\frac{1}{2}$ , length of aperture 13 mill.

The last specimen is the most swollen of all. It has  $7\frac{1}{2}$  whorls. The sculpture of the nucleus does not differ from that of *B. sporadicus*. (*Ancey*, Le Naturaliste, April 1, 1901, p. 82.)

B. DELUMBIS Reeve. Pl. 25, fig. 15.

Shell perforate, globose-conic, rather solid, rugulose-striate, little shining; white, ornamented with longitudinal chestnut lines interrupted somewhat into bands. Spire conic, a little acute. Whorls 6,

convex, the last about as long as the spire, inflated. Columella somewhat straightened; aperture a little oblique, sinuate-oval; peristome simple, unexpanded, the columellar margin noticeably dilated to the base, vaulted, reflexed. Length 21, diam.  $12\frac{1}{2}$  mill.; aperture 12 mill. long,  $6\frac{1}{2}$  wide (*Pfr.*). *Habitat unknown* (Cuming coll.).

*Bulimus dehumbis* RVE., *Conch. Icon.* pl. 76, f. 555 (August, 1849).—PFR., *Monogr.* iii, p. 418; iv, 477; vi, 124.

“Very delicately tinged with orange and purple-violet in the aperture” (*Rve.*)

B. TURRITELLATUS (Beck). Vol. x, p. 193.

Reported from Matto Grosso Province, Brazil, by Ancey, collected by Germain and H. H. Smith. It is said by Mr. Ancey to be quite variable. The shell, usually grayish-white with darker streaks in the direction of growth lines, and irregularly placed, is sometimes ochre-brown with the streaks more or less distinct.

Var. *pliculosa* Ancey. Shell ovate-attenuate, openly and rather widely perforate, somewhat thin, whitish-buff, ornamented with narrow streaks in the direction of growth-lines, somewhat glossy, closely and somewhat irregularly pliculose. Spire ovate-tapering, rather acute. Whorls 7, a little convex, the last ovate; suture moderate. Peristome expanded throughout, more dilated at the columella. Length 27, diam.  $14\frac{1}{2}$ , length of aperture  $13\frac{1}{2}$  mill.

S. W. Brazil: *Matto-Grosso* (Germain).

*Bulimulus turritella* Orb., var. *pliculosa* Ancey *Le Naturaliste*, Apr. 15, 1901, p. 92.

B. PERVIUS Pfeiffer.

Shell umbilicate, obliquely ovate-conic, rather solid, wrinkle-striate, opaque, white. Spire conic, rather acute; suture profound. Whorls  $6\frac{1}{2}$ , convex, the last slightly exceeding the spire, somewhat obliquely produced basally, subcompressed around the narrow but pervious umbilicus. Columella lightly arcuate. Aperture oblique, oval, rounded at base; peristome simple, the margins approximating, right margin a little expanded, columellar margin much dilated, slightly reflexed. Alt. 24, diam. 12 mill.; aperture, with peristome, 14 mill. long, 9 wide (*Pfr.*). *Habitat unknown.*

*Bulimus pervius* PFR., *P. Z. S.* 1853, p. 50; *Monogr.* iii, p. 651.

## Subgenus PLECTOSTYLUS (Vol. xi, p. 2.).

*B. BRODERIPPI* var. *ELONGATUS* Orb. This name was proposed by d'Orbigny (Voyage, p. 266) for narrower specimens of smaller size than *broderippi*, length 30, width 17 mill., taken by him at Cobija.

## Subgenus SCUTALUS Alb. (Vol. xi, p. 12).

*B. PROTEUS* (Brod.). Vol. xi, p. 13.

Add to references: *Bulimus proteus* SEMPER, Reisen im Archip. Phil., Landmoll., p. 152 (anatomy);—*Bulimulus proteus* STREBEL, Beitr. Mex. Land- und Süßw.-Conch. v, p. 58, pl. 13, f. 2; pl. 14, f. 3a-g; pl. 16, f. 1 (anatomy). [Probably not *B. proteus* W. G. Binney, Ann. Lyc. N. H. N. Y., ix, p. 37, nor *Scutalus proteus* W. G. Binney, Ann. N. Y. Acad. Sci. iii, p. 123, = *Neopetræus rhodolarynx*?]. *Scutalus rhodolarynx* W. G. Binney, Ann. N. Y. Acad. Sci. iii, p. 123, pl. 12, f. D.

Mr. Binney may have had his preparations of the radula of this species and a *Neopetræus* transposed. See foot of p. 171, vol. xi.

*B. VERSICOLOR* (Brod.). Vol. xi, p. 16.

Add to references: *Bulimulus versicolor* STREBEL, op. cit. p. 59, pl. 13, f. 4; pl. 14, f. 4a-e; pl. 16, f. 2 (anatomy).

*B. MERCURIUS* Pfeiffer. Vol. viii, p. 50, pl. 10, f. 12, 13.

This species is said by Dr. von Möllendorff to be no *Cochlostyla*, and he suggests that it may be a South American *Bulimus*. I know of none at all resembling it, though I quite agree with him in denying the propriety of including it in *Prochilus* or any Philippine group.

*B. STEEREI* Pilsbry. Pl. 18, figs. 50, 51, 52.

Shell umbilicate and *broadly rimate*, ovate-conic, with *straight-sided spire* and convex last whorl, *the base angular around a large umbilical excavation*; solid and strong, opaque soiled white, with indistinct brown stains in most specimens, and usually an indistinct, whiter girdle at the periphery, the apex white. Surface lustreless, *finely wrinkled longitudinally, and densely granose in spiral series*, as in *B. proteus* and *B. montezuma*; the granules small but strongly expressed. Apex obtuse, earlier  $1\frac{1}{2}$  whorls strongly vermiculate-wrinkled, the wrinkles anastomosing and largely transformed into a

netted pattern. Sutures not impressed, being filled by the peripheral keel of the young shell. Whorls  $6\frac{1}{2}$ , the first two convex, *those following almost completely flat*, the last whorl convex, without trace of a peripheral angle or carina, usually ascending in front. Aperture subvertical, ovate, built forward nearly to the level of the ventral convexity, brown tinted within; *peristome broadly expanded, thickened within*, brown or white, *acute at the edge*. Columella oblique, *making an angle with the basal margin*; its edge dilated; parietal callus moderate or slight, whitish.

Alt. 38, diam. 21, longest axis of aperture  $20\frac{1}{2}$ , width  $13\frac{1}{2}$  mill.

Alt. 35, diam. 20, longest axis of aperture 21, width  $13\frac{1}{2}$  mill.

Alt. 36, diam. 19, longest axis of aperture 20, width  $12\frac{1}{2}$  mill.

*Peru* (J. B. Steere expedition). Types in coll. A. N. S., No. 74, 144, and coll. University of Michigan.

*Bulimulus steerei* PILSBRY, Proc. Acad. Nat. Sci. Phila., 1900, p. 391 (August 9, 1900).

The granose surface gives this species some resemblance to *B. proteus*, but it differs in the characters of the aperture and the flat whorls of the spire. Young and half-grown shells are evidently acutely carinate at the periphery. In this respect *B. steerei* is like *B. coru* Orb., and other forms referred to the genus *Neopetræus*; but it has the apical sculpture of a true *Scutalus*, wholly unlike that of *Neopetræus*.

The deeply excavated tract behind the columellar lip leads to a tubular umbilicus, which is evidently large and open in immature shells, but is more or less constricted in most adults.

B. CRETACEUS (Pfeiffer). Pl. 22, figs. 74-78.

Shell umbilicate, ovate-conic, rather solid, striatulate and impressed-punctate, opaque, cretaceous. Spire convexly conic, the apex rather acute. Whorls 6, a trifle convex, the last a little longer than the spire, somewhat ascending in front, the base rounded around the deep, subcompressed umbilicus. Aperture slightly oblique, oblong-oval, brown inside; peristome thin, white-bordered, the margins converging, joined by a callus, the right margin broadly expanded, columellar margin brown, dilated, vaulted. Length 36, diam. 18, aperture inside  $17\frac{1}{2}$  mill. long, 10 wide (*Pfr.*).

*Rio Yonan, Peru* (Baron); "Eastern Islands" (Keppell, in Cumming coll.).

*Bulimus cretaceus* PFR., P. Z. S., 1854, p. 123; Monogr. iv, p. 396.

The figures represent specimens received from Mr. Fulton, from the locality first given above. That mentioned by Pfeiffer was evidently a guess. It has not before been figured.

The sculpture consists of fine, crowded growth-wrinkles cut into long granules arranged in spiral series. Usually these granules are quite weak, and scarcely or barely visible to the naked eye. The apical whorls have a dense thimble pitted pattern, much like that of *B. coræformis* (vol. xi, pl. 26, f. 85), and *B. baroni*. The color varies widely. On a white ground there are five brown bands and a brown umbilical patch, in some specimens; in others these bands may be almost wholly wanting, while still other examples have them confluent on the last whorl, or the whole surface may be dull brownish. The aperture may be either purplish-brown or white within, and the very broadly reflexed lip varies from wholly white to deep brown with a white border. The umbilicus is ample. Specimens measure:

Length 41, diam. 26, longest axis of aperture 25 mill.

Length 40, diam. 23, longest axis of aperture  $24\frac{1}{2}$  mill.

Length  $24\frac{1}{2}$ , diam.  $21\frac{1}{2}$ , longest axis of aperture 22 mill.

Length  $31\frac{1}{2}$ , diam.  $17\frac{1}{2}$ , longest axis of aperture  $17\frac{1}{2}$  mill.

B. BARONI Fulton. Vol. xi, p. 172.

This species is a Scutalus, close to *B. cretaceus*, *B. coræformis* and *B. proteiformis*.

B. CORÆFORMIS Pilsbry. Vol. xi, p. 15, pl. 25, f. 61; pl. 26, f. 85; pl. 30, f. 10-13.

B. TUPACU (Orb.). Vol. xi, p. 19.

Dr. A. Stübel took a specimen at Yrupana, Bolivia. It is short, like that figured by Reeve. (*Martens, Conch. Mittheil.*, p. 157.)

Information on Argentine specimens from the Sierras of Tucuman and Salta is given by Doering, *Periodico Zoologico* ii, pp. 256-258 (1877).

B. THAMNOICUS (Orb.). Vol. xi, p. 19. Pl. 16, fig. 3, 4.

Figures of a Bolivian specimen of the typical form are given.

## Section —

**B. DENTAXIS** n. sp. Pl. 25, figs. 16, 17.

Shell rimate, cylindric-tapering, rather thin; glossy, opaque *white*, *copiously striped with several shades of brown*. Spire long, tapering, with convex outlines, the apex rather obtuse. Whorls 7, the first sculptured with slight inconspicuous, waved and anastomosing wrinkles, and much better developed spiral striæ; the following whorls but slightly convex, with low or subobsolete wrinkles of growth, stronger below the sutures. Aperture long-ovate, striped within, somewhat oblique; peristome thin and acute, the outer margin regularly arcuate, scarcely expanded, the columellar margin reflexed above. *Columella bearing a strong obliquely entering callous fold or tooth*.

Length  $17\frac{1}{2}$ , diam. 6, longest axis of aperture 7 mill.

Length 19, diam.  $6\frac{1}{3}$ , longest axis of aperture  $7\frac{2}{3}$  mill.

*Peru* (Steere expd.).

The coloration reminds one of *Neopetræus lobbi*. The columellar tooth-like fold and the apical sculpture leave me in doubt where to place the species. It occurred with specimens of *B. andoicens* Morel.

Section *BULIMULUS s. str.*

**B. GUADALUPENSIS** (Brug.). Vol. xi, p. 38.

This name must replace that of *B. exilis*, as *Helix exilis* Gmel., Syst. p. 3668 was preoccupied by Gmelin on p. 3616 of the *Systema*.

Another Porto Rican locality is *Ceiba* (Blanner).

Additional references to the literature of *fraterculus* auct. (p. 40) are: Ann. Lyc. Nat. Hist. of N. Y. ii, p. 123. Journ. de Conchyl. 1890, pp. 25, 43; 1892, p. 23, 62, 66, 67. Jahrb. iv, 351. Conch. Mittheil. p. 163. *Bulimulus fraterculus* Strebel, tom. cit., p. 56, pl. 12, f. 16; pl. 13, f. 1-3; pl. 14, f. 1a-d (shell and anatomy of a Porto Rico specimen).

*Leptomerus limnæoides* Fér., W. G. BINNEY, Ann. N. Y. Acad. Sci. iii, p. 123, pl. 16, f. I (jaw); pl. 12, f. E (radula; specimen from St. Kitts).

*Leptomerus sepulchralis* W. G. BINNEY, Ann. N. Y. Acad. Sci. iii, p. 124, pl. 11, f. J (jaw and radula).

**B. CORIACEUS** (Pfr.). Vol. xi, p. 51.

Tabasco and San Juan Bautista (Smith); Cacofieto, Tehuantepec.

*B. UMBRATICUS* (Reeve). Vol. xi, p. 52.

Von Martens, *Biologia Centr. Amer.*, p. 251, suggests that this may be a *Stenogyroid* form.

*B. DYSONI* (Pfr.). Vol. xi, p. 56.

My identification of Yucatan specimens as *B. dysoni* (*Proc. Acad. N. S. Phila.* 1891, p. 315) was erroneous. There is no authentic record of the species from Yucatan.

Mr. Herbert H. Smith collected specimens in the Santa Marta range of Colombia, in dry forest, on shrubs and herbage, about 4 miles north of Bonda.

*B. CACTICOLUS* (Reeve).

Lives on Cacti, eating into them, according to Reeve. Moritz collected it at Puerto Cabello, and Ernst took a small form, var. *minor* Martens, at Caracas. In this the length is not over  $15\frac{1}{2}$  mill., the aperture comparatively smaller, not half the total length (*Binnenmoll. Venezuela's*, p. 187).

*B. HACHENSIS* (Reeve). Vol. XII, pl. 12, fig. 20.

Shell perforate, oblong-turreted, rather solid, nearly smooth, shining, buff. Spire long, acute. Whorls 7, but slightly convex, the last about two-fifths the total length, a trifle compressed below. Columella somewhat straightened. Aperture little oblique, truncate-oval; peristome simple, unexpanded, the columellar margin broadly reflexed above. Alt. 27, diam.  $10\frac{1}{2}$ , length of aperture  $10\frac{1}{2}$  mill. (Pfr.). *Banks of the Rio Hacha, Guatemala* (Rve.).

*Bulimus hachensis* RVE., *Conch. Icon.* pl. 85, f. 627 (Feb. 1850). —PFR., *Monogr.* iii, p. 421. *Conf.* von MARTENS, *Biol. Centr. Amer.*, p. 237.

"A delicate yellow shell of a peculiarly pyramidal form."  
"Pinkish yellow within and without" (Rve.).

This may be a *Drymaeus*, but on account of its similarity to *B. krebsianus* I leave it in *Bulimulus*. There is a Rio Hacha in northern Colombia, and I think with von Martens that the locality "Guatemala" is an error.

*B. INDISTINCTUS* Pfeiffer. (Vol. xi, pl. 45, fig. 28.)

Shell umbilicate, ovate-conic, solid, rather smooth, shining; white, indistinctly ornamented with two yellowish interrupted bands. Spire



long-conic, rather acute. Whorls 6, a little convex, the last shorter than the spire, somewhat compressed at base. Columella twisted. Aperture little oblique, subtetragonal oval, brownish inside; peristome thickened within, the margins subparallel, right margin sinuous above, columellar margin overhanging, reflexed. Alt. 26, diam. 12 mill.; aperture 13 mill. long (*Pfr.*). *Habitat unknown.*

*Bulimus monilifer* REEVE, *Conch. Icon.*, pl. 48, f. 318 (Nov., 1848), not of Gould.—*Bulimus indistinctus* *PFR.*, *Zeitschr. f. Malak.*, 1852, p. 63.

Reminds one of some forms of *Bulimulus exilis* (*guadelupensis*). The generic position of *indistinctus* is unknown.

#### B. LUTEOLUS Ancy.

Shell ovate-conoid, very thin, a little glossy, pale green or buff-amber colored, slightly marked with close and obsolete growth-lines visible only under a lens. Spire conic, the apex rather minute and a little obtuse. Whorls 5, convex, regularly and rather rapidly increasing; suture simple, impressed; last whorl ovate, ample. Aperture suboblique, about one-third the length of the shell, oval, angulate above; peristome simple, unexpanded, acute, narrowly expanded and reflexed in a triangle over the small umbilical chink; margins distant. Length 14, diam. 9, alt. aperture  $7\frac{1}{2}$  mill. (*Anc.*).

Brazil: *Goyaz*.

*Bulimulus luteolus* *ANC.*, *Le Nat.*, April 1, 1901, p. 82.

"Seems allied to *B. limpidus* Drouet, of Guyana, by its general form, but it has a narrow perforation, while *limpidus* is quite imperforate. Moreover, the embryonal whorls, viewed under the microscope, are provided with very fine, undulating lines and scarcely visible spiral lines, while those of *limpidus* are finely and regularly reticulate."

#### B. STILBE n. sp. Pl. 25, fig. 18.

Shell very narrowly rimate, ovate-conic, thin and *very fragile*, of a pale greenish-yellow tint, fading above, and with a few narrow darker streaks; glossy, nearly smooth, the growth lines rather faint, base showing extremely superficial, faint and fine spiral striae. Whorls  $5\frac{1}{2}$ , the first sculptured with interrupted and waved wrinkles crossed by comparatively coarse and prominent spiral striae; the rest convex, last whorl moderately inflated. Aperture oblique, ovate, the outer lip thin and fragile, columellar margin regularly concave.

narrowly reflexed above. Length  $16\frac{1}{2}$ , diam.  $9\frac{1}{2}$ , longest axis of aperture  $9\frac{1}{2}$  mill.

Brazil: *E. do Sao Paulo* (Dr. H. von Ihering.)

An excessively fragile species, with peculiar apical sculpture.

B. DUKINFIELDI Melvill. Pl. 25, fig. 30.

Shell ovate-oblong, narrowly umbilicate, thin, olivaceous, almost smooth; whorls 6, the apical ones mamillate; sutures strongly impressed; longitudinally indistinctly obliquely striate, and under a lens spirally rugulose-striatulate; the last whorl much larger than the rest. Aperture whitish ashy, the peristome delicately reflexed, whitish, smooth, the columellar margin a little thickened, straight. Length 28, width 13 mill. (*Melv.*).

Brazil: *Salto Grande do Rio dos Patas* (upper waters of river Ivahy), Paraná (E. D. Jones, Esq.).

*Bulimulus (Drymaeus) dukinfieldi* Melv., Proc. Malac. Soc. Lond. iv, no. 3, p. 116, fig. (October, 1900).

"A plain but interesting species, procured from a district hitherto almost unworked, that does not seem much akin to any other of the genus known to me." It is named for Mr. E. Dukinfield Jones, who collected two specimens in 1899. Type in British Museum.

B. MARCIDUS (Pfeiffer). Pl. 25, figs. 23, 24.

Shell subperforate, ovate-oblong, very thin, striatulate, decussated by impressed concentric lines, slightly shining, pellucid, dull corneous. Spire oblong-conic, rather obtuse. Whorls 6, slightly convex, the last as long as the spire, somewhat tapering at base. Columella receding above, then vertical. Aperture oblique, oval; peristome simple, a very little expanded, the columellar margin a little reflexed, subappressed. Alt. 20, diam. 8; alt. of aperture  $10\frac{1}{3}$  mill. (*Pfr.*).

Brazil (coll. Pfr.).

*Bulimus marcidus* PFR., Monogr. iii, p. 435 (1853); P. Z. S., 1852, p. 67; Conchyl. Cab., p. 188, pl. 49, f. 11, 12.

"Very similar to *B. transparentis* Rve."

B. PLICATULUS (Pfr.). Vol. xi, p. 72.

Add to synonyms: *B. pliculatus* Pfr.-Cless., Nomencl. Hel. Viv., p. 244.

Section *Rhinus* Alb.

**B. SCOBINATUS** (Wood). Vol. xi, p. 77.

Reported from Bahia by Paz, Hidalgo, J. de C., 1875, p. 131.

**B. ARGENTINUS** Ancey.

Shell globose-ovate, rather solid, openly perforate, a little glossy, green or brown-buff, the last whorl encircled by a median, narrow, pale zone. Spire ovate-conoid, short, somewhat obtuse. Whorls  $6\frac{1}{2}$ , a little convex, regularly increasing, separate by an impressed suture, slightly striatulate, seen under a lens to be very obsoletely and closely sculptured with waved spiral lines; the last whorl ovate, ventricose. Aperture almost vertical, oval, tapering and angular above; peristome somewhat thickened, a little expanded, whitish, the margins remote, joined by a thin, glossy callus, the columellar margin broadly dilated over the well-marked perforation. Length 19–21, diam.  $12\frac{1}{2}$ –14, alt. apert.  $8\frac{1}{2}$ –11 mill. (Ancey).

Argentina: *Guaileguaychu*, Province of Entre-rios (L. de Vries).

*Bulimulus (Rhinus) argentinus* ANCEY, Le Naturaliste, April 15, 1901, p. 92.

This species, allied to *B. durus* Spix, has a more shortened and compact contour. The apical sculpture has not been described, so that its position is uncertain. It may belong to typical *Bulimulus* near *B. rushii*, to *Rhinus* or to *Protoglyptus*.

Section *Protoglyptus* (Manual xi, p. 84).

**B. MONTIVAGUS** (Orbigny). Vol. xi, p. 90.

Mr. Ancey (Le Nat. 1901, p. 92) thinks that *B. montivagus* Orb. was based upon several distinct forms, though he admits that the data available are insufficient to prove that view. In case the form from Corumba, Matto Grosso proves distinct from Orbigny's, he proposes for it the name *B. cutisculptus*. This form has been figured on my plate 14, f. 14, 15, of Vol. XI. I do not see the necessity for a new name until the matter can be adequately investigated.

Var. *chacoensis* Ancey. Shell imperforate, elongate, rather thin, a little shining, oblong, the apex acute; grayish, darker, rufous brown at the summit, the rest variegated with narrow brown streaks, with narrow, less conspicuous gray ones interposed; lightly sculptured with growth-lines which are not very much impressed, but are

quite visible in the middle. Spire produced, oblong-turrited. Whorls 8 to 9, slowly increasing, convex; suture impressed; last whorl subcylindric-oblong, tapering at the base. Aperture somewhat oblique, sinuate-oblong, angular above, on the right side and especially at the base effuse and expanded. Columella *contorted, the base generally receding towards the left*, a little thickened. Peristome acute, the margins remote, no callus joining them.

Length 22, diam.  $7\frac{1}{2}$ , length of the aperture  $8\frac{1}{2}$  mill.

Length 18, diam.  $7\frac{1}{2}$ , length of the aperture  $7\frac{1}{2}$  mill. (*Ancey*).

Bolivia: *Caiza, Gran Chaco* (Dr. Borelli).

*Bulimulus montivagus* var. *chacoensis* ANC., Boll. Mus. Zool. ed Anat. Comp. R. Univ. Torino, xii, no. 309, p. 16 (Nov. 30, 1897).

Differs from *montivagus* by being imperforate, with the columella twisted. The apical whorls are finely costulate, and in quite fresh specimens traces of fine spiral lines may be seen on the later whorls.

*B. POLLONERÆ* Ancey. Vol. XII, Pl. 45, fig. 30.

Shell pyramidal, almost imperforate, deep reddish-brown, and usually decorated with some narrow, suboblique, darker streaks; rather thin, silky-shining, slightly glossy; covered with a thin cuticle, which under the lens is seen to be ornamented with elevated, membranaceous lines, evanescent and very fine at the last whorl. Spire conoid-tapering, the apex acute. Whorls  $7\frac{1}{2}$ , slowly increasing, convex, suture impressed; last whorl wider, rounded, somewhat oblong. Aperture distinctly oblique, angular above, suboval, somewhat effuse below. Columella a trifle twisted above; peristome simple, acute, hardly effuse except along the columellar margin, reflexed over the very minute umbilical chink. Length  $15\frac{1}{2}$ , diam.  $6\frac{1}{2}$ , length of aperture  $5\frac{3}{4}$  mill. (*Anc.*).

Argentina: *San Lorenzo*, Province of Jujuy (Dr. Borelli).

*Bulimulus polloneræ* ANC., Boll. Mus. Zool. ed Anat. Comp. xii, no. 309, p. 17, pl., fig. 10 (Nov. 30, 1897).

Close to *B. montivagus*, but of a darker, purple-brown color, the aperture less oblong, etc.

*B. TRICHODES* (Orb.). Vol. xi, p. 92.

Ancey reports this species from San Lorenzo, Prov. Jujuy Argentina, from Caiza in the Gran Chaco, and the mission of San Francisco, on the upper Pilcomayo, Bolivia, collected by Borelli. The

apex is vertically costulate, as in *B. montivagus* (Boll. Mus. Zool. ed Anat. Comp. xii, no. 309, p. 18).

*B. PILEIFORMIS* (Moricand). Vol. xi, p. 181.

This species has the texture and sculpture of the thin, corneous forms of *Protoglyptus*, and I am now disposed to agree with Ancey (Le Naturaliste, 1901, p. 92), that *pileiformis* (and perhaps *gyrina* Val.) are *Bulimuli*, forming a series in that genus parallel to *Orychona* in *Drymæus*. The apex of *B. pileiformis* was illustrated in vol. xi, pl. 33, fig. 42. It was Dohrn who first suggested that *pileiformis* should be placed in *Bulimulus*, Jahrb. x, p. 352, 1883.

*Orychona bifasciata* has the apical sculpture of typical *Drymæus*.

*B. HÆMATOSPIRA* Pilsbry. Pl. 25, figs. 19, 20, 21.

Shell rimate, *pillar-shaped*, the last  $\frac{1}{4}$  whorls of about equal diameter and white, those above tapering and deepening to a blood-red color; thin, but moderately strong, opaque, nearly lustreless. Apex obtuse, the earlier  $1\frac{2}{3}$  whorls convex and sculptured with *delicate, spaced and straight longitudinal riblets*; next whorl or two nearly smooth, with merely some series of long granules; longitudinal ribs gradually appearing; the white, cylindrical portion of the shell being sculptured with strong, arcuate ribs, narrower than their intervals, and several spiral series of long, narrow, crowded granules. Whorls  $8\frac{1}{2}$  to 9, the earlier convex, the later 3 or 4 somewhat flattened. Aperture small, oval, longer than wide, white within; peristome simple and unexpanded.

Length 16, diam. above aperture 3; aperture 3 mill. long.

Length 16.3, diam. above aperture 3; aperture 3 mill. long.

Length 15, diam. above aperture 3.1; aperture 3 mill. long.

*Locality unknown, probably Peru.* Types in coll. A. N. S., No. 78,135, and in coll. University of Michigan.

*Bulimulus hæmatospira* PILSB., Proc. Acad. Nat. Sci., Phila., 1900, p. 392.

This beautiful little *Bulimulus* would be considered a *Peronæus*, from its narrow form and calcareous texture, were it not for the apical sculpture, which is like that of *Næsiotus*, *Protoglyptus* and *Orthotomium*. This shows it to be not a *Peronæus*, but a stock of different ancestry, parallel to that group, such as I have shown to exist in various *Bulimulid* groups. It stands in such a relation to *Proto-*

*glyptus* as *Peronæus* to *Lissoacme*, or *Plicolumna* to typical forms of *Orthotomium*.

Subgenus *NÆSIOTUS* Alb. (Vol. xi, p. 94).

Prof. W. H. Dall has given a supplemental report on Galapagos snails, based on specimens collected by Messrs. R. E. Snodgrass and E. Heller (Proc. Acad. Nat. Sci. Phila. 1900, p. 88); describing the following new species:

*B. SNODGRASSI* Dall. Pl. 24, fig. 2.

*Bulimulus* having the general form of *B. perspectivus* Pfr., with a distinct suture and eight polished moderately convex whorls; apex attenuated, nucleus livid, with an apical dimple and fine regular ribbing which becomes obsolete on later whorls; there is also on the first four whorls more or less spiral sculpture of microscopically fine lines, which also disappear on later whorls; subsequent whorls smooth or with fine incremental lines; upper whorls dark purplish brown, later ones a little paler, with a narrow paler band just behind the suture, which on the last whorl becomes strongly marked, with a dark reddish narrower band on each side of it, and traces of another at the suture; in some specimens the dark coloration covers the whole surface on each side of the peripheral pale band, but inside the aperture the bands can always be distinguished; base rounded about a well-marked umbilicus; aperture small, ovate, marginally thickened and slightly expanded, but not reflected; a narrow band of callus over the body connects the posterior ends of the lips; pillar broad, slightly swollen, external coloration visible in the throat. Alt. of shell 17, of aperture 5.2, diam. of shell 6, of aperture 4 mill. (*Dall*).

Galapagos: *Hood Island* (Snodgrass and Heller), numerous.

*Bulimulus snodgrassi* DALL, Proc. A. N. S. Phila. 1900, p. 90, pl. 8, f. 2.

This species is smaller than *B. perspectivus* and differently colored, but belongs to the same group.

*B. APPROXIMATUS* Dall. Pl. 24, fig. 3.

Shell belonging to the type of *B. nux* and *B. rugulosus* with seven pretty evenly tapered whorls, with a distinct suture; nucleus as in the last species, livid, but the early whorls bear no traces of revolv-

ing lines; whorls moderately convex, base evenly rounded; sculpture on the later whorls only of faint incremental lines; umbilicus small and narrow, aperture rather elongate. Alt. of shell 17.5, diam. 8 mill. (*Dall*).

Galapagos: *Hood Island* (Snodgrass and Heller).

*Bulimulus approximatus* DALL, P. A. N. S. 1900, p. 90, pl. 8, f. 4.

"A single specimen of this shell was obtained which differs from all the others of the *nux* group in the absence of spiral sculpture and the smooth and polished surface. The peristome is not quite matured, so it cannot be determined whether it is reflected or not, but the probabilities are in favor of its being simple and unreflected."

B. HOODENSIS Dall. Pl. 24, fig. 4.

Shell allied to *B. unifasciatus* Sby., but smaller, with about six convex, rapidly-tapering whorls; nucleus sculptured as usual in the group, livid purple; later whorls smooth, polished, with no sculpture but faint incremental lines; color light yellowish-brown, with two broad reddish-purple spiral bands nearly peripheral, and a narrower one in front of the suture; base evenly rounded, with a narrow but deep umbilicus; aperture ovate oblong, the peristome white, thickened and distinctly reflected; pillar broad, white, not swollen, a thin wash of callus over the body, the external coloration distinct within the aperture. Alt. of shell 18, of aperture 8.5, diam. of shell 8.5, of aperture 6 mill. (*Dall*).

Galapagos: *Hood Island* (Snodgrass and Heller.)

*Bulimulus hoodensis* DALL, P. A. N. S., 1900, p. 91, pl. 8, f. 1.

"This well-marked form more nearly resembles some of the continental species than the typical *Næsioti*. The distinctly-reflected lip and rapid enlargement of the whorls distinguish it from any other Galapagos species."

B. JACOBI (Sowerby). Vol. xi, p. 111.

"This seems to be the commonest and, among the islands, the most generally distributed species of the Galapagos. It was obtained by Messrs. Snodgrass and Heller at James and Albemarle, where it was previously known, and also from Narborough and Abingdon, where it had not previously been reported. There is not a great deal of variation in the specimens, which were found at elevations of from

1,700 to 2,000 feet. The form named *cinereus* by Reibisch was obtained at Ignana Cove, Albemarle Island, and the variety *acutus* Reibisch, at a height of 3,000 feet, near Tagus Cove, Albemarle Island. The species is usually found under flat pieces of rock, and a large proportion of the specimens are dead." (*Dall*, l. c., p. 91.)

Notes on new localities for known species follow :

*B. DUNCANUS* Dall (p. 114). Specimens were taken on Duncan Island. "As in previous cases, all the specimens were dead, and those collected were not quite mature, as the parietal denticle had appeared in none of them. The species is probably extinct."

*B. ESCHARIFERUS* Sowerby (p. 108). Chatham and Barrington Islands, Snodgrass and Heller. This species had not been found at Barrington previously.

*B. TANNERI* Dall (p. 113). Tagus Cove, Albemarle Island (Snodgrass and Heller). This species was previously known from Indefatigable Island. The present specimens are not fully grown, and do not show the broadly reflected lip.

*B. INDEFATIGABILIS* Dall. (Vol. xi, p. 123, pl. 24, f. 49.)

This name is proposed for the hitherto nameless new species figured by Dall in 1896.

#### Section ORTHOTOMIUM C. & F.

*B. DEALBATUS* (Say). Vol. xi, p. 128.

Monterey, state of Nuevo Leon, Mexico (S. N. Rhoads). Large specimens of *B. d. schiedeanus* occurred at Saltillo, Coahuila, Mex.

*B. ALTERNATUS* (Say). Vol. xi, p. 134.

Monterey, state of Nuevo Leon, Mexico (S. N. Rhoads).

*B. SUFFLATUS* (Gld.). Vol. xi, p. 136.

Add reference: *Mormus sufflatus* GLD., W. G. BINNEY, Ann. N. Y. Acad. Sci., iii, p. 123 (jaw and teeth).

#### Genus NEOPETREUS Martens (Vol. xi, p. 163).

The typical forms of this genus have very characteristic apical sculpture, but in some species referred here, this sculpture is wanting, the apex being smooth. A knowledge of the soft anatomy is



necessary to decide whether all these are forms of *Neopetræus* in which the apical sculpture has degenerated, or whether they really belong to other groups. In *N. lobbi*, *N. decussatus* and *N. myristicus* a gradual loss of the apical sculpture can be traced, demonstrating that in some forms of *Neopetræus* a smooth apex has been acquired secondarily. *N. rhodolarynx* (Reeve), vol. xi, p. 171, has a smooth nepionic shell, like that of *Lissoacme*. Its position is uncertain.

*B. baroni* Fult. (vol. xi, p. 172) has the apical sculpture typical of *Scutabus*, and should be removed from *Neopetræus*.

*N. ARBORIFERUS* Pils. Vol. xi, p. 175.

A clear pinkish specimen, without streaks, is in coll. American Museum of Natural History, New York.

*N. PLATYSTOMUS* (Pfeiffer). Pl. 22, figs. 81, 82.

Vol. xi, p. 172. Specimens from Vina, Peru, are here figured. They are cream-white with a fleshy tint, irregularly marked with ochre and purplish-brown streaks, the peristome white at the edge, purple or purple-brown within, the interior cream-tinted. The apex has the form and sculpture of that of *N. atahualpa*. Umbilicus very ample in the wider specimens, compressed in the narrower.

Length 40, diam.  $21\frac{1}{2}$ , longest axis of aperture 21 mill.

Length 40, diam. 16, longest axis of aperture  $18\frac{1}{2}$  mill.

*N. PATASENSIS* (Pfeiffer). Pl. 22, figs. 79, 80.

Vol. xi, p. 176. Two specimens, apparently referable to this species, are figured. The general pattern of coloring is essentially like *altoperuvianus* and *decussatus*. On the latter part of the last whorl there are bold purple-brown markings, or the peculiar pattern may be replaced by coalescent purplish-black streaks. Apical whorls as in *N. atahualpa*, but somewhat more rounded.

*N. LOBBI* (Reeve). Pl. 22, figs. 83, 84, 85.

Vol. xi, p. 177. Three specimens collected by Prof. Steere are figured to show the leading stages in the loss of color-stripes. Fig. 83 has the typical coloration. In Fig. 84 the stripes are obsolete above the periphery, except for occasional dots along the suture on the last three whorls. In Fig. 85 there are no stripes whatever on the blue-white surface, only the subsutural dots remaining.

The apical sculpture is very shallow, in some specimens not easily seen, or subobsolete.

*N. DECUSSATUS* (Reeve). Vol. xi, p. 178.

Typical specimens from Cajabamba, with the color-pattern and proportions of Reeve's figure, have the apex smooth and glossy, sometimes showing faintly the characteristic *Neopetræus* pattern of sculpture in places.

*N. myristicus* (Rve.) from the same locality has a similar apex, faintly showing the sculpture. I think it will prove to be a form of *decussatus*, with which it agrees completely in all but color-pattern.

#### Genus OXYCHONA Mörch.

*O. BIFASCIATA* (Burrow). Vol. xi, p. 181.

Var. *mimarmum* Ancey. Shell smaller and more elevated than the type, weaker. Spire perfectly conic, the apex of the same color; whorls  $6\frac{3}{4}$ , flat, the last flatly sloping, the base more flattened, encircled below the carina with two small brown lines. Aperture with the upper margin straightly descending, hardly sinuous, angulate but hardly produced in a beak; the basal margin almost rectilinear beyond the angle, then forming an obtuse angle with the columellar lip, the latter thickened and sloping. Peristome black-brown, the parietal part whitish, slightly tinted with brown at the insertions. Length  $15\frac{1}{2}$ , diam. 15 mil. (Ancey, Le Nat. 1901, p. 93).

Brazil: Prov. Minas Geraes.

#### Genus DRYMÆUS Albers.

*D. ABYSSORUM* (Orb.). Vol. xi, p. 192.

San Lorenzo, prov. Jujuy, Argentina (Dr. Borelli). Mr. Ancey (Boll. Mus. Zool. ed Anat. Comp. Torino, xii, no. 309, p. 12) considers *abyssorum*, *hygrohylæus* and *marmarinus* of d'Orbigny to be variations of one species.

*D. FUSOIDES* (Orb.). Vol. xi, p. 201.

Ancey reports it from Santa Cruz de la Sierra (P. Germain); the specimens being entirely ochre yellow, with some irregular brown flammules. The aperture is violaceous inside (Le Nat. 1901, p. 93).

*D. PEELII* (Reeve). Pl. 25, fig. 22.

Vol. xi, p. 205. *D. fordii*, p. 205, is closely related to this species, differing chiefly in the more strongly spiral columella, and

in having a whorl less. As usual in *Drymæus*, the coloration varies a good deal in *peelii*, a specimen with but few markings being illustrated here.

*D. COGNATUS* n. sp. Pl. 23, figs. 3, 4, 5, 6, 7.

Shell fusiform, thin, white with corneous or purplish wavy longitudinal streaks or bands *dotted with white*, often combined with three dark girdles, continuous or interrupted, and also white-dotted. Spire long and slender, the first  $1\frac{1}{2}$  whorls with typical *Drymæus* sculpture, succeeding whorls somewhat glossy, marked with slight growth-lines and faint spiral incised striae. Whorls  $6\frac{1}{2}$  to 7, slightly convex. Aperture vertical, ovate, showing the external color-pattern vividly within, the peristome thin, *broadly expanded*, subreflexed, white, usually tinted with lilac within; columellar margin broadly dilated above, over an ample and deep umbilical fissure; columella entering as a very strongly spiral fold.

Length 45, diam.  $18\frac{1}{2}$ , longest axis of aperture  $21\frac{1}{2}$  mill.

Length 39, diam. 16, longest axis of aperture  $19\frac{1}{2}$  mill.

Length 33, diam. 14, longest axis of aperture  $16\frac{1}{2}$  mill.

Colombia: *Bogotá*.

This species is closely related to *D. zoogeographicus* Orb. and *D. membielinus* Crosse, but seems distinct from both. The figures show sufficiently its wide range of variation in color and size. In some specimens there are no purple-black markings, while in others these replace to a large extent the corneous brown portions of the pattern of paler shells.

*D. EXPANSUS* (Pfeiffer). Pl. 25, figs. 25-29.

Vol. xi, p. 222. This species has a wide range of variation, as shown by an extensive series collected by Prof. Steere at Tarapoto, Peru. It undoubtedly includes *D. scitus* and *D. protractus* as varieties. At Tarapoto specimens similar to pl. 34, f. 5 of vol. xi, occurred with typical var. *aurisratti*, and a smaller form, pl. 25, figs. 25, 26. At another locality, unfortunately not noted, the specimens are all small, varying from almost typical *expansus* contour to a much narrower form with reduced umbilical chink; white with inconspicuous corneous streaks, or copiously marked, the apex black; lilac tint within the mouth almost invisible, faint, or strong (pl. 25, figs. 27, 28, 29). I have called this form var. *subprotractus*.

Var. *perenensis* Da Costa (pl. 48, fig. 54). Shell compressed-umbilicate, ovate-pyramidal, covered with longitudinal close riblets; whitish, variegated with arrow-shaped bands. Whorls  $6\frac{1}{2}$ , convex, the penultimate more swollen than the others. Columella twisted, receding. Aperture ample, inverted ear-shaped, lilac within; peristome white, expanded and reflexed, a little squared at the base. Length 46, diam. 23, length of apert. 22, width 17 mill. (*Da Costa*, Proc. Malac. Soc. Lond. iv, 239, pl. 24, f. 5.) According to Mr. Da Costa this form invariably has a less expanded lip than typical *expansus*, the body-whorl is less ventricose, while the upper ones are much more swollen; the maculation is also more pronounced and of a darker color, while the umbilicus is much more contracted and not so deep as in the type. The penultimate whorl is more swollen than in var. *aurisratti* Phil., which resembles *perenensis* in color and sculpture.

D. SUBVENTRICOSUS Da Costa. Pl. 48, fig. 48.

Shell acuminate-oblong, umbilicate, rather thin, whitish, violaceous brown. Whorls 7, subventricose, with impressed sutures, longitudinally rudely elevate-striate. Aperture ovate, purplish inside, exceeding two-fifths the total length; peristome acute, a little reflexed, white-margined; columella slightly reflexed. Length 30, diam. 14; aperture, length 13, width 8 mill. (*Da Costa*.)

Colombia: *Bogota*.

*D. subventricosus* Da C., l. c., p. 239, pl. 24, f. 4 (Oct. 1901).

D. EXOTICUS Da Costa. Pl. 48, fig. 52.

Shell ovate-conic, scarcely umbilicate, rather thin, smooth, glossy, whitish, longitudinally streaked and maculate with violaceous-brown. Whorls 6, somewhat swollen, the sutures impressed. Aperture ample, about one-half the total length, streaked with violaceous within; peristome acute and reflexed, columella dilated, reflexed. Length 23.5, diam. 11; length of aperture 11, width 7.5 mill. (*Da Costa*.)

Colombia: The hot country, *upper Magdalena River*.

*D. exoticus* Da C., l. c., p. 239, pl. 24, f. 10 (Oct. 1901).

D. ELSTERI Da Costa. Pl. 48 fig. 53.

Shell oblong-turreted, imperforate, a little solid, rather smooth, very minutely striated under the lens; whitish, with reddish streaks

bent in zigzag, and dotted with white. Spire long conic. Whorls 6, moderately convex, the last obliquely produced. Columella straight, roseate. Aperture oblong-oval, lilac colored within; peristome roseate, dilated, the right margin expanded. Length 34, diam. 15; aperture length 18, width 9 mill. (*Da Costa*.)

Peru: *Chachapoyas*, prov. Amazonas.

*D. elsteri* Da C., Proc. Malac. Soc. Lond. iv, p. 238, pl. 24, f. 6 (Oct. 1901).

"An unnamed example of this species is in the Cuming collection in the British Museum. The writer received a few specimens from the Governor of the Province of Amazonas, through the instrumentality of his friend Mr. Elster of Lima (since deceased), after whom the species is named. The shells from which the type is selected vary considerably in both form and coloration, and will be found to resemble many of the species of *Drymæus* from Colombia, which latter are generally, however, deeply umbilicated." (*Da Costa*.)

*D. OBLIQUISTRIATUS* Da Costa. Pl. 48, fig. 45.

Shell pyramidal-oblong, umbilicate; sutures impressed; olivaceous-brown, sparsely marked here and there with brown streaks; delicately and very closely obliquely striate. Spire acuminate. Whorls 8, convex. Aperture oblong, intensely black-brown inside, about three-sevenths the length of the shell; lip simple, columella nearly straight, reflexed. Length 30, diam. 12; aperture length 12, width 6 mill. (*Da Costa*.)

Peru: *San Pablo*.

*D. obliquistriatus* Da C., Proc. Malac. Soc. Lond. iv, p. 238, pl. 24, f. 2 (Oct., 1901).

*D. CYLINDRICUS* Da Costa. Pl. 48, fig. 46.

Shell subcylindrically turreted, narrowly perforate, rather solid, obliquely subrugosely striate; dull rose-corneous, covered with a thin brown cuticle; apex subpapillar; suture impressed. Whorls  $7\frac{1}{2}$ , very little convex. Aperture oblique, about two fifths the length of the shell, a little tapering at base; peristome simple, the columella a little reflexed. Length 30, diam. 11; aperture, length 12, width 5 mill. (*Da Costa*.)

Peru: *San Pablo*.

*D. cylindricus* Da C., *t. c.*, p. 238, pl. 24, f. 3 (Oct., 1901).

*D. STRIGATUS* (Sowerby). Pl. 25, figs. 31, 32, 33.

The examination of about a quart of specimens collected by Prof. Steere at Tarapoto, Peru, shows that the forms I admitted as varieties are merely more or less salient color-patterns in a continuous series of variations. None of them are varieties in the true sense. Three patterns, not hitherto illustrated, are here figured.

*D. RECTILINEARIS* (Pfr.). Vol. ix, p. 232.

Taken at Tarapoto by Prof. Steere, in several color-varieties. White with two wide brown bands on the base, the early whorls yellow. Similar, but densely streaked obliquely with opaque white throughout, the early whorls purplish. Pale orange-yellow, brighter towards the tip and base, with two narrow basal bands. They vary from length  $21\frac{1}{2}$ , diam. 11, to length 25, diam. 12 mill.

*D. DUTAILLYI* (Pfeiffer).

Shell subperforate, oblong-turreted, thin, closely plicatulate, shining; whitish, ornamented with 6 or 7 interrupted spadiceous bands. Spire lengthened, the apex acute. Whorls 7, a little convex, the last about two-fifths the length of shell, tapering at base. Columella slightly arcuate, somewhat receding. Aperture slightly oblique, elliptical-oblong; peristome simple, unexpanded, the columellar margin paper-like, reflexed and subadnate above. Alt. 31, diam. 12 mill.; aperture  $13\frac{1}{2}$  mill. long,  $6\frac{1}{2}$  wide (Pfr.).

*Brazil* (Dutailly in Cuming coll.).

*Bulimus dutaillyi* PFR., P. Z. S., 1856, p. 390; Monogr. iv, p. 470.

Seems to belong to the group of *D. papyraceus*.

*D. PUNCTICULATUS* (Pfeiffer).

Shell profoundly and compressedly umbilicate, ovate-conic, rather thin, smoothish, shining; whitish, with sparsely scattered, pellucid dots. Spire long-conic, rather acute. Whorls 7, rather flat, the upper buff; last whorl shorter than the spire, ascending anteriorly, slightly compressed basally. Columella somewhat receding, lightly arcuate. Aperture subvertical, oblong oval; peristome simple, the right margin narrowly expanded, columellar margin very much dilated, somewhat flexuous. Alt. 29, diam.  $12\frac{1}{2}$  mill.; aperture with peristome 14 mill. long,  $8\frac{2}{3}$  wide. (Pfr.) *Bolivia* (Cuming coll.)

*Bulimus puncticulatus* PFR., P. Z. S., 1856, p. 390; Monogr. iv, p. 404.

**D. LENTIGINOSUS** Philippi.

Shell subimperforate, oblong-fusiform, plicatulate, very smooth, thin; whitish, painted with scarlet streaks usually interrupted. Whorls  $6\frac{1}{2}$ , a little convex, the last about four-ninths the total length. Aperture ovate-oblong, the columella rather straightened; peristome thin, acute, unexpanded, the columellar margin dilated above, adnate, closing the umbilical chink. Length  $24\frac{1}{2}$ , width  $11\frac{1}{2}$  mill.; aperture  $12\frac{1}{2}$  high,  $5\frac{1}{2}$  wide (*Phil.*).

Peru: *Between Cajamarca and Contumazá* (Isern).

*Bulinus lentiginosus* PHIL., Malak. Bl., 1869, xvi, p. 32.—PFR., Monogr. viii, p. 147.

Described from a single imperfect specimen, which has very delicate, scarcely raised, very smooth plicæ, like the related Peruvian species, and white spots here and there interrupt the streaks. The embryonic whorls are smooth and corneous. It has not been figured or recognized by subsequent writers.

**D. VEXILLUM** (Wood). Pl. 26, figs. 34, 35.

A series collected by Steere at Magdalena, Peru, shows great variation, and indicates that *varians*, *rubellus* and *tigris* are color-forms of *vexillum*. Some specimens have six wide or narrow continuous blackish bands; in others the upper four bands are interrupted to squarish spots. Still others show various transitions to *D. tigris*, of which *B. keppelli* Pfr. (vol. xi, p. 296) seems to be merely a variety. *D. vexillum*, *D. tigris* and *D. keppelli* have been sent from the Rio Yonau, from Fulton. Specimens of *keppelli* are figured (pl. 26, figs. 36, 37).

**D. INTERPUNCTUS** (Martens). Vol. xi, p. 287.

Evidently of wide distribution in prov. Sao Paulo, Brazil. Dr. von Ihering sends specimens from Piquete.

**D. SEMIMACULATUS** Pils. Vol. xi, p. 297.

The locality "San Nicolas, central Nicaragua (Tate)" should be deleted. Tate's shells, some of which are before me, are *D. dominicus*.

**D. GERETI** (Ancey).

Shell oblong-attenuated, narrowly rimate, thin, rather pellucid, shining, whitish-subhyaline, polished, under a lens seen to be incised

with spiral lines; apex marked with brown, microscopically and regularly decussate. Spire tapering-conic, produced, the apex rather minute, a little obtuse. Whorls 6, a little convex, regularly increasing, suture not very deep; last whorl oval, scarcely deflexed in front, ornamented with four narrow, equidistant brown bands and sometimes a fifth linear one below the suture; the lower band encircling the umbilical chink, the first and second running upon the penultimate whorl. Aperture suboblique, oblong, narrowed and angular above; peristome simple, unexpanded, acute, scarcely spreading, reflexed in a long triangle at the columella. Length 19, diam. 9, alt. apert. 9 mill. (*Anc.*).

Brazil: *Province of Goyaz.*

*D. gereti* ANC., *Le Naturaliste*, April 15, 1901, p. 93.

This pretty species, dedicated to Mr. Paul G  ret, superintendent of the conchological sales-room of the Deyrolle establishment, resembles certain Antillean species, but I know of no Brazilian species which approaches it much. It resembles *D. mariellinus* Poey, of Cuba and Florida, but is larger; the ground-color of the shell is white, not amber, the color of the bands is darker and their arrangement not the same. It has also some analogy to the banded variety of *D. vincentinus* Pfr. (*Aucey*).

*D. SUCCINEA* n. sp. Pl. 26, fig. 38.

Shell imperforate, ovate, *excessively thin*, somewhat *transparent*, with the texture of *Succinea*. Pale yellow, very glossy, sculptured with coarse, *irregularly spaced, oblique, narrow folds*. Spire short, the apex obtuse, with the usual sculpture of *Drym  us*. Whorls  $4\frac{3}{4}$ , moderately convex, the last rather inflated, carinate in front at the periphery, especially in immature specimens. Aperture oblique, ovate, the outer lip thin and simple; columellar margin thin below, reflexed and adnate above. Length 14, diam.  $8\frac{1}{2}$  mill.

*Amazon river* (Steere Exped.).

This species differs from *limpidus* Drouet, and *guttula* Pfr., in being plicate. In contour it resembles *colmeiroi* Hid., but differs in sculpture and color.

*D. FUNERALIS* Brugniere.

Shell *imperforate*, similar in form and size to *B. radiatus*, but thinner, brighter white, and marked with 5 black spiral bands on the last whorl, the two lower wide, middle one narrow, the others



almost as wide as those on the base. Whorls 6, the summit a little more pointed than in *B. radiatus*. The outer lip is unexpanded and acute. The columella is simple, visibly spreading and almost notched at the base inside. Length 9, diam. 5 lines. Interior of South America, collected by M. le Dr. Blond, of Cayenne.

*Bulinus funeralis* BRUG., Encycl. Méth. i, p. 321.

An unrecognized species, probably allied to or identical with *D. nigrofasciatus* Pfr., vol. xi, p. 307.

*D. ROSEATUS* var. *MONTANUS* nov. Pl. 48, fig. 51.

Shell narrowly perforate, fusiform, thin; almost white, with a few irregularly spaced, narrow vertical, brown stripes on the last 4 whorls, above the periphery. Surface glossy, faintly striatulate, and closely engraved with minute spirals. Whorls 6, slightly convex, the last indistinctly subangular at the periphery in front, tapering below. Aperture a trifle effuse at base, white inside, with a bright yellow streak within the expansion of the lip; peristome thin, the lip expanded outwardly and below, pale-edged; columellar margin vertical, reflexed, yellow; parietal wall pale yellow. Length 28.5, diam. 12.3, longest axis of aperture 14.5 mill.

Colombia: Western part of the *Santa Marta Mts. at Las Pantidas*, about 4,000 ft. elevation (Herbert H. Smith).

The narrow stripes do not run with the growth-lines, and have the appearance of the darker stripes of *D. oreades* Orb.

*D. SANCTEMARTHÆ* n. sp. Pl. 48, fig. 49, 50.

Shell narrowly rimate, long and slender, rather thin; pale pink, marked above the periphery with oblique interrupted streaks of various shades of purple-brown; the spots so formed are arranged in three spiral series, and some of them are very faint. The suture has a whitish margin below, and there is a pink area around the perforation. Surface glossy, lightly striatulate and densely engraved with minute spirals. Spire slender, with slightly convex outlines. Whorls  $6\frac{1}{2}$ , slightly convex, the last rather flattened at the sides, very convex immediately around the somewhat excavated umbilical region. Aperture quite oblique, effuse below, nearly white inside; peristome distinctly thickened within though thin at the edge, the basal and lower part of the outer lip broadly flaring. *Columella very concave*, with narrowly reflexed, pale yellow margin; parietal wall

pale buff-pink. Length 31.5, diam. 12, longest axis of the aperture 16 mill.

Colombia: *Jiracasaca*, on the northwestern slope of the Santa Marta range at about 2,500 ft. elevation. (H. H. Smith.)

The spotted pattern of the spire recalls some forms of *D. trigonostomus*, but in the structure of the aperture and columella it is near *D. castus*.

*D. CHIRIQUIENSIS* Da Costa. Pl. 48, fig. 47.

Shell fusiform-ovate, sub-umbilicate, rather thin, whitish, painted with three purplish-brown zones, with longitudinal streaks of the same color between them, covered with a silky cuticle. Whorls 6, convex, obliquely striate, the apex granulate-striate. Aperture ovate, very large; lip reflexed, pale salmon-colored; columella narrowly reflexed. Length 29, diam. 14, aperture 17 mill. long, 8 wide (*Da Costa*).

*Boqueti, Chiriqui, Panama.*

*D. chiriquiensis* Da C., Proc. Malac. Soc. Lond. iv, p. 238, pl. 24, f. 1 (Oct., 1901).

"A single specimen only has been received of this pretty shell. The combination of color and markings render it an object of much beauty. The cancellation produced by the chocolate bands crossed by the waved longitudinal stripes on the white ground give it a latticed appearance, which is sharply defined within the interior; under the lens the nepionic whorls show the usual thimble-like sculpture of *Drymæus*." (*Da Costa*.)

The collection made by Mr. and Mrs. S. N. Rhoads, in Mexico, in 1899, contains the following species:

*D. dunkeri* (Pfr.). Vol. xii, p. 45. Patzcuaro, Morelia and Tzintzuntzan, state of Michoacan.

*D. hegewischi* (Pfr.). Vol. xii, p. 52. Texolo, prov. Vera Cruz.

*D. aurifluus* (Pfr.). Vol. xii, p. 55. Jalapa, prov. Vera Cruz.

*D. sulphureus* (Pfr.). Vol. xii, p. 76. Texolo, prov. Vera Cruz.

*D. COLIMENSIS* (Rolle). Pl. 24, fig. 13.

Vol. xii, p. 47. The figure given is from von Martens (Biol. Centr. Amer., p. 630, pl. 44, f. 9), and represents one of the original specimens.

*D. INUSITATUS* (Fulton). Pl. 26, fig. 43.

Shell *sinistral*, perforate, thin, of a rather bright yellow color with

some corneous-yellow, subtranslucent streaks; glossy, smoothish, sculptured with faint growth-wrinkles and very minute, shallow, engraved spirals. Whorls  $7\frac{1}{2}$ , moderately convex, the first  $1\frac{1}{2}$  having the minute decussate sculpture of *Drymæus*. Aperture ovate, oblique, the outer lip thin, well-expanded below, columellar lip very broadly, triangularly reflexed above.

Length  $29\frac{1}{2}$ , diam. 13, length of aperture  $12\frac{1}{2}$  mm. (type).

Length 30, diam. 13, longest axis of aperture 13 mm.

*Costa Rica* (Underwood).

*Bulinulus (Drymæus) inusitatus* FULTON, The Nautilus xiv, p. 87 (December, 1900).

Closely related to *D. tropicalis* Morel. of Yucatan, but differing in color and the distinctly expanded outer and basal margins of the peristome. Figured from one of the original lot.

*D. OBLIQUUS* (Reeve). Vol. xii, p. 93.

Ancey (Le Naturaliste, 1901, p. 93) describes two varieties: Var. *monozona* Anc. is white, with a median reddish-brown band on the last whorl; from Bahia. Var. *pæcillogramma* Anc. is from the Province of Minas Geraes; length 27 mill.; the summit is rose with a black dot at the tip; last whorl ornamented at the suture with a narrow black band, below which there is a brownish-yellow band, then a wider red zone, followed by another narrow brownish-yellow band, then a quite wide blackish band, and finally around the umbilicus there is a brownish-yellow band, also rather wide.

Genus PORPHYROBAPHE (Vol. xii, p. 149).

*P. SUBIRRORATUS* (Da Costa). Pl. 24, fig. 11.

Shell acuminate-oblong, swollen in the middle, imperforate. Whorls 6, sculptured with very delicate spiral impressed lines (visible under the lens), finely plicate beneath the suture. Columella simple. Chestnut-purple, longitudinally streaked with ashy-brown; columella blue white; lip reflexed, rose-colored; aperture iridescent, lilac. Length 63, diam. 33 mill.; aperture with peristome 34 mill. long, 22 wide (*Da Costa*).

*Paramba, Ecuador.*

*Strophocheilus (Eurytus) subirroratus* DA COSTA, Proc. Malac. Soc. Lond. iii, p. 83, fig. II (July, 1898).

"This species presents a general resemblance in form to *S. irro-*

*ratus* Rve., but differs from it in the absence of the raised striae which cover that shell and the peculiar crenulation beneath its sutures."

P. FLORI Jousseaume.

Shell imperforate, oblong, solid, ornamented with vanishing oblique striae, somewhat shining; white painted with flammules and streaks of violaceous-brown and black; spire long-conic, a little obtuse; suture impressed, crenulated; whorls 7, slightly convex, rather regularly increasing. Aperture nearly vertical, truncate-oval, with a pearly silver-brown luster inside; peristome somewhat thickened, narrowly expanded, grayish-lilac; columella twisted, whitish within. Alt. 85, diam. 39 mill.; aperture 39 mill. long. greater diam. 30, lesser 22 mill. (*Jouss.*). *Machala, Ecuador* (L.-M. Flor.).

*Dryptus flori* JOUSS., *Le Naturaliste*, xix, p. 265, Nov., 1897.

This species, which I have seen in certain collections under the name *B. integer*, is distinguished at once by the more slender form, absence of revolving striae, the brilliance and nearly effaced longitudinal striae of the surface, and by the stronger and shorter torsion of the columellar margin, and often by a purple-black zone at the base of the last whorl (*Jouss.*).

Genus OXYSTYLA Schlüter.

O. PRINCEPS var. ELEGANS Rolle. Pl. 24, fig. 12.

Vol. xii, p. 117. Von Martens has given a figure of Rolle's type, now in the Berlin Museum (*Biol. Centr. Amer.*, Moll., p. 629, pl. 44, f. 15). He considers it "only an attenuated variety of *O. princeps*."

O. ZONIFERA var. NOBILIS Rolle. Pl. 24, fig. 14.

Vol. xii, p. 124. "An attenuated variety of *O. zoniferus*" (Martens, t. c., p. 629, pl. 44, f. 16). Type in Berlin Museum.

O. PULCHELLA var. PROTOTYPUS Pils. Vol. xii, p. 137.

Specimens from Corumbá, prov. Matto Grosso, Brazil, are in coll. C. W. Johnson. An adult shell from Bahia, sent by Dr. H. von Ihering, measures length 40, diam. 25 mill.

O. MARACAIBENSIS (Pfr.). Pl. 26, fig. 47.

Vol. xii, p. 137. At Bonda, a place 8 miles S.-E. of Santa Marta,

Colombia, Mr. H. H. Smith collected numerous specimens of this species and its color-variety *imitator*. The specimens of *maracubensis* are boldly marked with black-brown or bluish thrice-waved stripes, usually branching above, often with three reddish-brown bands more or less interrupted. The largest measure, length 55, diam. 32 mill. One of these is figured. The var. *imitator* with them vary from pale brown to fleshy, and are mostly three-banded, some of the half-grown specimens having a fourth band at the base. Some show traces of flames.

OXYSTYLA PHLOGERA (Orb.). Pl. 26, figs. 48, 49.

Vol. xii, p. 145. The specimen here illustrated was received from Dr. von Ihering, labeled Araguary, Minas (no. 1123). It has many brown stripes on a creamy ground, the stripes distinct on the spire, obsolete on the last whorl except in front. The whorls of the spire are bisected by a median, spiral, reddish-brown line, somewhat dotted, and on the last whorl becoming obsolete. The apex is black, this color forming a wide belt below the suture of the first  $1\frac{1}{2}$  whorls, then changing to a series of alternately dark and white spots bounded by a brown line below. These gradually become stripes, which are narrower and twice as numerous above as below the median brown line, becoming wider downward, and on the penult. whorl forming a series of oblique blackish spots alternating with narrower creamy ones just above the suture, and continuing at the periphery of the last whorl, which has in addition a continuous spiral band on the base. A broad blackish varix-stripe is near the end of the penult. whorl, and there are two varices on the back of the last whorl. The interior is bright lilac; the parietal wall, columella and a basal area around it are black. The columella is strongly twisted, and markedly convex in the middle. Length 44, diam. 24, longest axis of aperture 23 mill.; whorls  $6\frac{1}{4}$ .

The surface is faintly marked with growth-striae, and shows slight evanescent traces of spiral lines on the spire.

LIGUUS VIRGINEUS L. Vol. xii, p. 162.

Add to synonyms: *Helix regina* Féruss., BOWDICH, Elem. of Conch., pl. 8, f. 26.

## VOL. XIII.

Genus BOTHRIEMBRYON (Vol. xiii, p. 1).

Kobelt, in the last fascicle of the *Conchylien Cabinet*, monograph of *Buliminus*, follows that genus with *Bothriembryon* (p. 763), which he admits to generic rank. His monograph would be bettered by a knowledge of recent Australian and American work.

*B. MARTENSI* Kobelt. Pl. 26, figs. 45, 46.

Shell with completely closed axis, long ovate, rather thin but solid, irregularly striate-costate, seen under a lens to be encircled by nearly obsolete spiral lines; brownish, copiously marked with chestnut and buff-white streaks. Spire conic, the apex very obtuse, the three earlier whorls pitted, tip turned in; suture very finely crenulate, narrowly edged with buff-white. Whorls 6, regularly increasing, a little convex, the three earlier pitted, the third ornamented with regularly-placed, pale-brown, oblique stripes; last whorl four-sevenths the shell's length, slightly inflated, rounded beneath, hardly descending in front. Aperture subvertical, oval, the external streaks showing through the blue interior; peristome simple, unexpanded, the outer margin produced at the insertion, basal margin narrowly rounded, columellar margin nearly vertical, quite narrowly reflexed for a long distance, appressed, completely closing the perforation. Length 42, diam. 23.5, alt. aperture 22.5, width 14 mill. (*Kob.*).

*Australia* (type in Berlin Museum).

*Bothriembryon martensi* KOB., *Conchyl. Cab.*, monograph of *Buliminus*, p. 764, pl. 112, f. 3, 4 (August, 1901).

With the same number of whorls, this species is but two-thirds the size of *Panda atomata*; the whorls are more convex, it is completely imperforate, and has only traces of spiral lines. Described from a single specimen. The pattern of the apical sculpture is not described by Kobelt with sufficient exactness to permit positive reference of this form to *Panda* or *Bothriembryon*. In the former, granules are arranged in spiral series; in the latter there are pits in oblique sweeps. From what Kobelt says I would think the species correctly located.

*B. ONSLOWI* var. *MINOR* Pilsbry (Vol. xiii, p. 12).

A synonym is: *B. onslowi* var. *hartogensis* Kobelt, *Conch. Cab.*, p. 770 (1901).

## Genus PLACOSTYLUS Beck.

*Placostylus bivaricosus* var. *cuniculinsulæ* Cox. (Vol. xiii, p. 26.)

References to illustrations should be: pl. 12, f. 5, and pl. 11, f. 1.

*Melania striata* Perry, Conchology, pl. 29, f. 5 (1811), *Helix melania* Fér., Prodr., p. 57, no. 448, is evidently a *Placostylus*, and may be *P. fibratus*.

## Subgenus LEUCOCHARIS Pils.

PLACOSTYLUS PORPHYROCHILA (Dautz. et Bernier). Pl. 48, figs. 55, 56.

Shell solid, narrowly umbilicate. Spire conic, turreted. Whorls 6, a little convex and joined by an impressed suture; the last whorl more than half the length of the shell. First whorl usually seen under a strong lens to be sculptured with very fine punctures, arranged in rows; following whorls ornamented with inconspicuous growth-folds, on the last two whorls there are stronger folds cut by very irregular transverse striae. Aperture ovate and oblique; peristome broadly expanded, the margins joined by an adnate callus. Columella twisted inwardly, covering the umbilicus outwardly; lip reflexed and towards the base broadly dilated. Color dull yellowish-white. Aperture broadly painted with brown within and narrowly margined with white outwardly. Length 43, width 22; length of aperture with peristome 23, width 16 mill. *New Caledonia*.

*Leucocharis porphyrochila* DAUTZENBERG & BERNIER, Journ. de Conchyl. xlix, no. 3, p. 215, pl. 7, f. 5, 6 (Oct., 1901).

A remarkable form, larger than the species of *Leucocharis* previously known, thicker, with more oblique aperture and brighter coloring in the mouth.

## Genus AMPHIDROMUS Alb.

*Amphidromus moniliferus* Gld. (p. 179). Add the reference: *Buliminus* (*Rhachis*) *theobaldianus* Bs., KOBELT, Conchyl. Cab., p. 672, pl. 102, f. 14.

A. LATESTRIGATUS Schepman. Pl. 49, figs. 5, 6.

Vol. xiii, p. 207. New figures are here given of this beautiful and variable species.

A. LÆVUS (Müller). Vol. xiii, p. 214.

The name was incorrectly given "*lævis*" in the text.

*A. RHODOSTYLUS* Möllendorff.

Shell sinistral, rimate, long ovate-conic, rather solid, delicately striatulate, microscopically decussate spirally, opaque; usually yellow, unicolor or variously marked (see below). Spire rather long with straight sides. Whorls 7, the upper ones flat, penultimate a little convex, the last whorl moderately convex, separated by a brown-lined suture. Aperture moderately oblique, somewhat ear-shaped; peristome a little expanded, slightly reflexed; columella straight, rose-tinted, forming a more or less distinct angle with the base. Length 38–45.6, diam. 20–21.4 mill. (*Mlldff.*).

Color-forms: *A.* (simplex), uniform yellow, with only a brown sutural line and browner umbilical spot; sometimes a few green bands near the end of the whorl. *B.* (roseolineata), having a narrow reddish adjoining the sutural band below; the last whorl reddish towards the aperture. *C.* (nigrolineata), umbilical zone wider; a black-brown band below the periphery. *D.* (igneae), upper whorls streaked with dark brown, the last whorl fire-red, with fading blackish streaks. *E.* (rhabdota), broad brown streaks fading towards the aperture. *F.* (bipartita), like color-form *E.*, but the last whorl greenish-brown below by the confluence of streaks, this nearly unicolorous zone bounded above by a sharp line. *G.* (subconfluens), streaks confluent, the last two whorls uniform brown, verging towards greenish or reddish. The last three forms intergrade. (*Mlldff.*)

*Pharang, Southern Annam* (Fruhstorfer).

*Amphidromus rhodostylus* MLLDFF., Nachbl. d. D. Malak. Ges., 1901, p. 47.

This Protean species assimilates best with the Group of *A. mouhoti* Pfr., though not the entire peristome, but only the columella is colored reddish. (*Mlldff.*).

*Group of A. janus* (Vol. xiii, p. 156).

*A. METABLETUS* Mlldff. Pl. 49, figs. 1, 2, 3, 4.

As Dr. von Möllendorff has pointed out, this species seems more allied to the *janus* group than to that in which I placed it, Manual xiii, p. 174, before I had seen specimens. It is now for the first time figured, the specimens being from the type locality. Dr. von Möllendorff has described two races in addition to the type form, in Nachbl. d. D. Malak. Ges. 1901, pp. 48–50.

Subsp. *puchychilus* v. Mlldff. Stronger-shelled throughout,



thicker lipped, parietal callus stronger; suture more distinctly margined; base less wide.

Length 39.5, diam. 20.5 mill.      Length 40.3, diam. 23.5 mill.

Length 39.7, diam. 22 mill.      Length 42.6, diam. 23.9 mill.

*Nha-trang, southern Annam* (Fruhstorfer).

The individual variations are even more numerous than in the type, the following "forms" being distinguishable: *A* (flava), uniform yellow. *B* (alba), uniform white. *C* (tritaeniata), yellow with 3 brown bands, the middle one sometimes lost. *D* (trizona), white with 3 bands. *E* (interrupta), like *D*, but the bands interrupted and reduced to rows of spots. *F* (confluens), like *D*, but the bands more or less widened and confluent. *G* (fusca), uniform brown by widening and union of the bands, except for a white sutural line. These forms occur both dextral and sinistral (*Mlldff.*).

Subsp. *insularis* Mlldff. Smaller, thinner-shelled, with the contour of *pachychilus*. Island Bai-min, near Nha-trang. The forms are less numerous than in the type or subsp. *pachychilus*, but this may be due to the smaller number of specimens taken, which includes pure white and banded white, banded yellow and nearly uniform brown specimens, representing the form *G*. (*Mlldff.*).

*A. INVERSUS* subsp. *ROSEOTINCTUS* Mlldff. (Vol. xiii, pp. 169, 237).

Dr. von Möllendorff states that the characters of this race are quite constant in more than 100 specimens examined from Fischaya. It apparently deserves recognition as a separate race locally differentiated from the *annamiticus* stock. (Nachbl. 1901, p. 50).

*A. HEMATOSTOMA* Mlldff. (Vol. xiii, p. 182).

This unfigured species belongs to the group of *A. mouhoti*, its nearest relatives being *smithi* Fult. and *cruentatus* Morel., according to Möllendorff, Nachrbl. 1901, 50.

*A. XIENGENSIS* Morlet. Vol. xiii, p. 194.

Mr. H. Fischer (Journ. de Conchyl. xlix, 1901, p. 156, foot-note no. 1) proposes to emend this name to correspond with the present orthography of the original locality *Xieng-Sen*, making it *A. xieng-sensis*. Such changes seem of doubtful utility.

#### Genus ODONTOSTOMUS.

Dr. A. Doering has given an artificial key to the species of

*Odontostomus* in the *Periodico Zoologico*, vol. 1, part 3, pp. 172-180.

*O. GEMELLATUS* Ancey, n. sp.

"Shell oblong-tapering, rather solid, ashen-whitish, obliquely rimate, obliquely costulate except at the apex. Spire oblong, the sides a little convex, apex obtuse, sculptured as in *O. pupoides*. Whorls  $7\frac{1}{2}$ , a little convex, regularly increasing, separated by a moderate suture, the last whorl oblong, very shortly ascending at the aperture. Aperture nearly vertical, truncate-oval, ringent, obstructed by teeth or folds as follows: Two on the parietal wall, one large, elongated, prominent, situated near the posterior angle, the other smaller and more deeply placed, at the base of the larger one, and in the middle of the parietal wall; a large, twisted, sub-quadrant and tongue-shaped tooth on the columella; two subequal, rather small and acute basal teeth; and within the outer lip there are three teeth, the lower strong, twisted, opposite the columellar lamella, the others rather small and acute. Peristome thickened and dilated, expanded, white, the margins distant; marked with brown on each side of the bases of the teeth upon the outer lip. Length 20, diam.  $7\frac{1}{2}$ , alt. apert.  $7\frac{1}{2}$  mill." (*Ancey*).

*Goyaz, central Brazil.*

"Of the size and shape of *O. pupoides*, but strongly and regularly sculptured. The teeth also are dissimilar" (*Ancey*).

*O. TUDICULATUS* (Martens). Pl. 26, figs. 40, 41, 42.

This vol., p. 55. Fig. 40 represents a specimen from Taguara do Mundo Novo, Rio Grande do Sul, collected by Dr. von Ihering in 1881, and determined by Prof. von Martens. It measures, length  $21\frac{1}{4}$ , diam. 6, length of aperture 7 mill.; whorls nearly 8.

Other specimens from Bahuru, Sao Paulo (no. 1279 coll. Mus. Paulista), received from von Ihering, differs in having the spire somewhat more attenuated, and the teeth within the outer lip more or less deficient. In the specimen represented in fig. 41 there are upper and lower palatal folds and the faint trace of a suprapalatal. In that shown in fig. 42 only the upper palatal is developed, and that but weakly, though close inspection with a lens shows very slight vestiges of basal and suprapalatal folds. The basal carina is reduced. Except by their small size, there is little or nothing to separate such specimens from *O. janeirensis* var. *miniola*.

It is obvious that *O. miliola*, *fusiformis* and *tudiculatus* are very closely linked together, and probably will prove but stages in an uninterrupted series of variations. All have the same sculpture, a network of cream-white wrinkles on a darker ground. For the present, *tudiculatus* may be distinguished by its more slender contour and less broadly expanded outer lip.

*O. PATAGONICUS* (Orb.). Pl. 26, fig. 44.

See this vol., p. 95. A specimen from Carmen de Patagones, near the mouth of the Rio Negro, Patagonia, received from Dr. H. von Ihering, shows better developed teeth than those from the Sierra Ventana. The shell is rather calcareous, suffused with a livid flesh tint, and stained with blackish-blue above. The parietal lamella is perceptibly bifid outwardly, and with the columellar lamella and upper palatal fold, is well developed. There is a small basal fold, but no trace of lower palatal or suprapalatal folds, or of a transverse barrier within. The throat is ochre colored. The apex has rather strong, very close and almost straight riblets. Length  $19\frac{1}{2}$ , diam. 10 mill.

It will be noticed that the locality of these specimens is far south of the limits assigned by Döring, who thought the species did not extend southwest to the Rio Colorado.

#### *Undetermined Bulimulidæ.*

*Bulimus fragilis* Lam. (An. s. Vert. vi, pt. 2, p. 123; Delessert, Rec. de Coq. pl. 28, f. 2), described as British, is apparently one of the thin whitish tropical American species, such as *Drymæus stramineus*, *liliaceus*, *virginalis*, or their allies. It cannot be identified without comparison of the type. The locality assigned by Lamarck was due to his identification of it with *Helix fragilis* Montagu = *Limnæa stagnalis*.

*Helix* (*Cochlogena*) *ovum* Fér., Prodr. p. 54, no. 409, *Bulimus ovum* Beck, Index, p. 52, nude name.

*Bulimus apicinus* Menke. Shell ovate-acute, subperforate, the apex rufous. Length 9 lines (*Menke*, Verzeich. Conch. Samml. Malsburg, 1829, p. 6).

*Bulimus ponderosus* Christofori & Jan. Shell ovate, ventricose, perforate, milk white; aperture ample, ovate; peristome with the columellar lip reflexed. Length 1 inch, diam. 7 lines, aperture 6

lines long, 4 wide. Peru. (*C. & J.*, Catalogus, sect. ii, pt. 1, Mantissa, p. 3, 1832; *Pfr.*, Monogr. ii, 89). According to Pfeiffer, a specimen in Gruner's collection to which Ziegler had attached this name agrees well with the description, and is very similar to *B. nucleus*. It looks like a fossil shell.

*Bulimus versicolor* Cristofori & Jan. Shell oblong, ovate, subperforate, longitudinally striated, greenish-rufous, variegated with white spots. Aperture oval; peristome reflexed, white. Length  $1\frac{1}{2}$  inches, diam. 10 lines; aperture 1 inch long, 6 lines wide. *Brazil*. (*Cristofori & Jan.*, Catalogus, etc., Mantissa, p. 3, 1832); *Pfr.*, Monogr. ii, p. 47. Not *Bulinus versicolor* Brod., see p. 16 of vol. xi.

May be a *Gonyostomus*.

*Bulimus christiani* Beck, Brazil, inter. (Index p. 52.)

*Bulimus grossus* Beck, Brazil, inter. (Index p. 53.)

*Bulimus compressus* Beck, Am. Merid. (Index p. 53.)

*Gonyostomus concolor* Beck, Rep. Argent. (Index p. 53.)

*Bulinulus chrysotrema* Beck, Am. m. (Index p. 63.)

*Bulinulus figulinus* Beck, Brazil, Bah. (Index p. 65.)

*Bulinulus assumptionis* Valenc., Beck, I. Assumption (Index p. 67.)

*Bulinulus chiriquanus* Beck, Bolivia (Index p. 68).

All undescribed and unknown to later authors.

*Bulimus tenuis* Anton. “= ? *B. corneus* Desh. Very fragile, long ovate-conoidal; 6 flat whorls, the last as long as all the rest; spire rather long; minutely longitudinally, and still more minutely transversely striated; unicolored horn-brown, lustrous. Apex shining. Perforated. Aperture acutely ovate; peristome sharp, the columella dilated partly over umbilicus. Alt. 8, diam.  $3\frac{1}{2}$  lines. Similar to *B. collini* Mich., but slenderer, the last whorl not swollen, having one whorl more, and a longer, narrower aperture” (*Anton*, Verzeichniss der Conchyl. in der Sammlung von H. E. Anton, p. 42, 1839). Habitat unknown.

*Bulinus laticolor* Sowerby. (Vol. xiii, Pl. 45, fig. 29.) Known only by a dorsal view of the shell. This shows a decussated buff surface, rather produced, turreted spire, and apparently a narrowly expanded lip. Habitat and present location of type unknown. It may be either a *Lissoacme*, typical *Bulinulus* or a *Drymæus*; and will probably defy certain identification. (Conch. Illustr. p. 48. *Bulinus laticolor* *Pfr.*) Aucey (*J. de C.* 1901) has identified with

as a species in his collection having the apical structure of *Orthotomium*.

*Bulinus vermetus* Anthony (cover of Haldeman's Monograph of Limniades, no. 3, July, 1841, BINNEY, Terr. Moll. iv. p. 137, PFR., Monogr. vi, 153), said to be from Cincinnati, Ohio, is a lost species which American students have not been able to trace.

*Bulinus vaporeus* Mousson. Shell almost imperforate, ovate-globose, very thin and very fragile, costulate-striate and most minutely subgranulate, diaphanous, pale corneous. Spire obtusely convex-conoid, the nucleus small, smooth; suture impressed, very narrowly margined. Whorls  $4\frac{1}{2}$ , the upper flatly convex, the last inflated, sloping above, rounded beneath, less striate on the dorsal line, but spirally lineate or subsulcate. Aperture slightly oblique ( $25^{\circ}$  with the axis), angularly ovate, large; peristome defective (unexpanded and acute?); the margins joined by a very thin parietal callus, right margin less curved above, then more so; columellar margin vertical, elongate, reflexed and appressed above. Length 31, diam, 27 mill.; ratio of aperture 4.3; rat. whorls 3.2 (*Mouss. Malak.* Bl. xvi, 1869, p. 174.—PFR., Monogr. viii, p. 180.

*South America* (Wallis).

Described from a single specimen with defective peristome and probably not adult. It is apparently a very young *Strophocheilus*.

*Bulinulus proteli* Moric., Peru, Paetel, Catal., 1883, p. 145.

*Bulinulus subsuctatus* Mss., N. Granad., Paetel, Catal., 1873, p. 101.

*Bulinulus uber* Mke., Amer. m., Paetel, Catal., 1873, p. 101.

*Bulinus baltovica* Rv., Quito, Paetel, Catal., 1869, p. 80.

*Bulinulus*. Under the head "a new species of *Bulinulus*," a marine shell, *Eulimella occidentalis*, was described by Hemphill, *Zoe* iv, p. 395.

## Family CERIONIDÆ.

Characters those of the following genus.

Genus CERION 'Bolten' Mörch, 1852.

*Cerion* BOLTEN, Museum Boltenianum p. 90, 1798, in part, undefined.—MOERCH, Catal. Yoldi. p. 33, *ura* the first species (1852).—DALL, Bull. Mus. Comp. Zool. xxv, no. 9, p. 120.—PILSBRY & VANATTA Proc. Acad. Nat. Sci., Phila., 1896, pp. 315–329.—*Strophia* ALBERS, Die Hel., 1850, p. 202. Not *Strophia* Meigen, 1832.—*Cochlodon* SOWERBY, Tankerville Catalogue, p. 40, 1825, in part.

Shell solid, cretaceous, cylindric or ovate, conic above, rimate or perforate, composed of 8 to 13 compactly coiled whorls, the central axis slender, hollow above, usually solid below; apex entire. Aperture ovate, vertical, the lip usually expanded or reflexed. A spiral columellar fold and a parietal tooth usually are present in recent species.

Lung macroscopically plain except for the pulmonary vein. Kidney oblong, with large cavity, and excreting apparently by a secondary ureter. Genital system having a wide atrium, short penis with terminal retractor, *the epiphallus entering near or below the middle of the penis sac. Vas deferens extremely long.* Spermatheca on a long duct which bears *a long diverticulum.* A vaginal retractor *arises from the right tentacular muscle.* Free retractor muscles independent to their posterior ends except the right tentacular and tail retractors, which are shortly united. Jaw smooth. Teeth of the normal type in Holopoda, the ectocones developed. External anatomy as in Holopoda generally; the labial processes well developed.

Type *C. ura* (L.). Distribution, the Antilles, near the sea. They live on bushes or other herbage, rarely retreating under stones.

*Cerion*, from the Greek word kerion, honey-comb, alludes to the resemblance of the spire to an old-fashioned bee-hive.

The genus *Cerion*, or as it is commonly known, *Strophia*, is one of the most characteristic forms of West Indian land-molluscan life. With two exceptions, the species are all insular; *C. incanum* and *C. antonii* only, the former from the Florida Keys and perhaps the adjacent mainland, the latter reported to be from Guiana, are continental. The Greater Antilles—Cuba, Hayti and Porto Rico, with the Virgin Islands and the entire group of the Bahamas, are inhabited

by numerous species, with a multitude of local races. South of the larger islands named, if we include with Cuba the faunally dependent Cayman group and Isle of Pines, but one single species is found. *C. ura*, of Curaçao, singularly isolated in characters as well as geographically. Jamaica is without a species; and the genus also fails in the Caribbean chain.

In the main, each species is confined to some single island, or to a series of adjacent keys or islets; but there are numerous exceptions, where forms unquestionably conspecific are found on several islands separated by considerable distances.

The species are subject to a remarkable range of individual and local variation. Thus many species vary from strongly and conspicuously ribbed to entirely ribless and smooth. In fact this is a common variation, incontestably established by the series we have examined of *Cerion dimidiatum*, *C. columna*, *C. regina*, *C. ura*, *C. maritimum*, *C. sagraianum* and many other species. Color is equally variable, pure white species varying to heavily brown-mottled, and this not in one, but in many of the species. Absolute size of adults is almost as mutable as in *Cypræa*; and occasionally individuals are abnormally shortened by the premature assumption of the features of maturity, giving them a stunted appearance.

All of these considerations render the study of the species one of unusual difficulty; and the older authors, unacquainted with the Protean nature of the species, as with the usually restricted range of each, often failed to properly discriminate them. Thus the several volumes of Pfeiffer's *Monographia Heliceorum Viventium* are unreliable in dealing with many species, especially in respect to geographic distribution.

An American writer on natural history, Mr. C. J. Maynard, some years ago begun the study of this genus, and to his earliest publication on the subject we owe the first clear statement of some facts of prime importance; that the Cerions are excessively plastic, and locally modified into a considerable number of species and subspecies; that the range of some of these forms is excessively limited; and that former authors had failed to discriminate many really distinct species, "lumping" them under a few old names; and finally, that the aperture-armature, or "teeth" of the Cerions are variously arranged, and furnish ground for the division of the genus into several sub-genera. Mr. Maynard, moreover, has discovered and de-

scribed a large number of most interesting species and varieties, so that his work on this genus has been an important one. However, he has unduly multiplied species and sub-species, basing them on characters we hold to be too slight and inconstant, and his work is marred by inaccuracies of all kinds.

In 1896, Mr. Vanatta and the writer published a catalogue of the genus, embodying the results of both biologic and synonymic study. This catalogue has served as a basis for the present monograph, although further study with more material has modified some of the conclusions then reached, and has resulted in a grouping of the species believed to be more natural.

The more striking peculiarities of *Cerion*, besides the pupiform, compact and calcareous shell, are (1) the low entrance of the epiphallus into the penis, a feature I do not remember noticing in any other genus; (2) the excessively long free vas deferens; (3) the diverticulum of the spermathecal duct (occurring also in *Helix*, *Buliminus*, *Clausilia*); (4) the rather short, oblong kidney, with very extensive lumen.

The external anatomy, teeth, jaw, and most other details present nothing unusual in ground-snails of the Holopod group.

*Cerion* has been associated with the *Pupidae* by most authors, but there is little in the anatomy to justify such an association, while the pallial organs and genitalia show it to belong to a widely different group.

#### *General Anatomy of Cerion.*

The lung in *C. mumia chrysalis* is about three times as long as wide, traversed along the middle by a large pulmonary vein, with no large branches, the reticulation being quite invisible in an unstained, non-injected preparation. The kidney is about double the length of the pericardium, and has a very large cavity. The secondary ureter is not noticeably differentiated (pl. 47, fig. 30). In *C. incana* Leidy distinctly figured a branching reticulation of the lung anteriorly, and a secondary ureter; whether correctly or not, only additional examination will show.

The radula is normal in shape; teeth 27, 1, 27 in *C. m. chrysalis* and *C. incanum*, 30, 1, 30 in *C. regium* and *C. abacoense*. The central tooth is rather wide, the length of the basal plate sometimes exceeding, sometimes surpassed by the median cusp; side cusps well developed. The laterals have a long inner cusp, bifid beyond the



9th tooth, and a short outer cusp. The marginal teeth are short and wide, with two cusps (pl. 47, fig. 35, *C. incanum*; fig. 36, *C. columna*, both after Binney).

In *C. regium*, *incanum* and *chrysalis*, the basal plate of the central tooth is as short as the middle cusp; in *C. abacoense* and *C. columna* it is longer.

Semper (Reisen im Phil. Archip., p. 128) says that *C. ura* has 95 to 99 teeth in a row, all the teeth with several cusps. This is a third more teeth in a row than the other species examined, which have 55 to 60.

The jaw (pl. 47, fig. 29, *C. m. chrysalis*) is rather strongly arcuate, solid, smooth, with a small median projection below. This projection is said to be wanting in *C. ura*, but is present in other species examined.

Free muscles (pl. 47, fig. 28, *C. m. chrysalis*). The left tentacular and ocular retractor and the pharyngeal retractor are free almost throughout, being united with the columellar muscle at its proximal end only. The right tentacular and ocular retractor is united with the columellar muscle for a short distance, and distally it gives off a broad muscular band inserted on the vagina, functioning as a vaginal retractor. The eye retracts between the branches of the genitalia, as usual.

The genital system (pl. 47, fig. 34, *C. m. chrysalis*) is of normal general proportions and position. The atrium is very capacious and contains a short, tongue-shaped fleshy appendage. The penis is stout below, tapering rapidly, with a long slender retractor muscle arising at its apex and inserted upon the lung-floor. Its inner walls are coarsely plicate longitudinally. Below the middle of the penis the epiphallus is inserted, entering between two fleshy lips. The epiphallus is glossy, moderately swollen, and passes into an exceedingly long, compactly coiled vas deferens (seen partially pulled out in the figure). The vagina is much shorter than the free oviduct. The spermatheca is oblong, on a long duct, which branches into a very long diverticulum, lying against the uterus (but pulled free in the figure). There is a strong vaginal retractor, given off from the right tentacular band, apparently a diverted anterior pedal retractor.

In copulation the atrium and penis are everted (pl. 47, figs. 32, 33), the former forming a sort of hood over the latter.

In *C. m. chrysalis* the spermatheca and duct are 19 mill. long, and the diverticulum 18 mill.

In *C. incanum*, dissected by Leidy, *C. mumiola* by Poey, and *C. yumaense*, by Vanatta, the penis retractor is short. In *C. yumaense* no spermathecal diverticulum was found, but I think this was due to the very poor preservation of the specimen dissected.

Young shells of this genus often have the aperture contracted by teeth, formed a short distance within the lip-edge, and subsequently absorbed in most cases. Two of these teeth are upon the parietal wall, two within the basal lip, and one upon the columella, the latter being the end of the continuous columellar plait, and present in the young of all species. In species having such teeth, when young, they are not present at all stages of growth, but only appear at intervals.

In *C. ura* only one of the basal teeth is usually visible from the mouth, the other being added with subsequent growth, deep in the throat. They often persist in adult individuals in this species only.

In *C. copium* (group of *C. pannosum*, Cayman Is.) there are two basal teeth, the outer smaller, and one tooth above, or none (pl. 47, fig. 31).

In *C. yumaense* a large series of young shows none with teeth; nor are any present in specimens of *C. y. sallei* *C. crassilabris* examined, all belonging to the group of *C. crassilabris*.

*C. incanum* sometimes has teeth, two above and two below, but most of the young shells examined have none. One young *multicosta* examined has no teeth.

*C. mumia* has one basal and two upper teeth, or is without any.

One young *C. regina* has a single rudimentary inner basal tooth, others being toothless.

One specimen of *C. glans* (form *agava*) has a rudimentary basal tooth, others being toothless. In *C. milleri* (pl. 36, fig. 47), four teeth are found. In a form of *glans* from Andros, Mr. Maynard found four teeth.

No sufficient data exist for testing the value of the teeth of the young as an indication of affinities. Collectors should secure large series of young shells, as the subject is one of some interest. Whether these teeth are lingering vestiges of a former adult dentition, or are an adaptation pertaining to the young stages only, remains problematic. Certain forms of *Holospira* have a somewhat similar internal structure.

*Subdivisions of Cerion.*

- I. Parietal lamella short, situated in the angle between the columella and parietal wall; axial lamella below it; whorls very short. Pl. 47, fig. 38. Subgenus CERION.
- II. Axial and parietal lamellæ present, the latter near the middle of the parietal wall, simple and short, usually not penetrating over one-third of a whorl. Pl. 47, figs. 37, 40. Subgenus STROPHIOPS.
- III. Axial and parietal lamella present, the latter very long and doubled, or short and interrupted, with an accessory denticle; rarely obsolete. Pl. 47, fig. 39. Subgenus DIACERION.
- IV. Axial and parietal lamella or teeth wanting.

Subgenus EOSTROPHIA.

NOTE.—Some forms of *Diacerion* in which the parietal armature is degenerate or incipient, have the structure of *Strophlops*.

The species are herein classified in fifteen groups, as follows:

Subgenus CERION (typical forms).

- 1. Group of *C. uva*. Curacao.

Subgenus STROPHIOPS Dall.

- 2. Group of *C. pannosum*. Little Cayman, Cayman}Brac.
- 3. Group of *C. crassilabris*.  
  - Species of Guiana.
  - Species of St. Croix, Porto Rico and Haiti.
  - Species of Grand Cayman.
- 4. Group of *C. cyclostomum*. Cuba.
- 5. Group of *C. maritimum*. Cuba.
- 6. Group of *C. scalarium*. Cuba, Bahamas.
- 7. Group of *C. mumia*. Cuba.
- 8. Group of *C. regina*. Bahamas.
- 9. Group of *C. gubernatoria*. Bahamas.
- 10. Group of *C. album*. Bahamas.
- 11. Group of *C. glans*. Bahamas.
- 12. Group of *C. martensi*. Bahamas.

Subgenus DIACERION Dall.

- 13. Group of *C. rubicundum*. Inagua.
- 14. Group of *C. striatellum*. Eastern Cuba.

Subgenus EOSTROPHIA Dall.

- 15. Group of *C. anodonta*. Tampa silex beds (Oligocene).

## Subgenus CERION, s. str.

Remarkable for the position of the parietal lamella, in the angle where the columella joins the whorl. The internal sets of laminae or teeth sometimes persist in mature shells, but as often are absorbed and absent, as in other groups of the genus.

C. UVA (Linné). Pl. 33, figs. 41-45.

Shell cylindric or wider above, rather solid, white, lustreless. Whorls  $10\frac{1}{2}$  to  $13\frac{1}{2}$ , the earlier  $2\frac{1}{2}$  nearly smooth, the rest regularly and strongly ribbed, the ribs as wide as their intervals or narrower, oblique and curved on the upper part, becoming nearly straight and less oblique below. Last 5 or 6 whorls of nearly equal width, forming the cylindric portion, those above rapidly tapering forming a short obtuse cone. Last whorl tapering below, the ribs often obsolete there. Umbilical chink deep. Aperture ovate or rounded, white or liver-brown within, having a small obtuse and very short lamella at the junction of the columella and parietal wall, and a sub-obsolete or scarcely perceptible columellar fold, which becomes stronger within, and winds up the internal column for 3 to 5 whorls. In many specimens the cavity of the whorls is contracted at one or more intervals by pairs of lamellae on the roof and floor of the cavity, a stronger development of the columellar lamella occurring at these places. Internal column wider and hollow above, narrow and solid in the lower 4 whorls.

Length  $25\frac{1}{2}$ , diam.  $9\frac{1}{2}$ , longest axis of aperture  $7\frac{1}{2}$  mill.

Length 24, diam.  $10\frac{1}{2}$ , longest axis of aperture  $7\frac{1}{2}$  mill.

Length 20, diam. 10, longest axis of aperture 7 mill.

Length 16, diam. 9, longest axis of aperture 6 mill.

*Island of Curacao.*

*Turbo uva* L., Syst. Nat. (10), p. 765.—Gmel., p. 3604.—*Bulimus uva* Brug., Encycl. Méth. p. 349.—*Helix (Cochlodonta) uva* Fér., Prodr., p. 58, no. 458; Histoire, pl. 153, f. 11-14.—*Pupa uva* Lam., An. s. Vert. vi, pt. 2, p. 105; edit. Desh., viii, p. 169.—Küster, Conchyl. Cab. p. 5, pl. 1, f. 3, 4.—Sowerby, Conchol. Man., p. 291; Conch. Icon. pl. 1, f. 7.—Desh., in Fér., Hist., p. 206.—Pfr., Monogr. ii, 317; iii, 537; iv, 659; vi, 292.—Wirt Robinson, A Flying Trip to the Tropics, p. 22, figs.—Semper, Reisen, Landmoll., p. 128, pl. 16, f. 11 (teeth).—*Cerion Apiarium* Bolt., Mus. Boltenianum p. 90 (1798).

*Cerion ura* MORCH, Catal. Yoldi, p. 33.—DALL, Bull. M. C. Zool. xxv, no. 9, p. 121, pl., f. 3.—PILS. & VAN., Proc. A. N. S. Phila. 1896, p. 318, with var. *desculptum*, pp. 318, 328, pl. 11, f. 1.

A very abundant shell in Curacao, easily recognized by the obtuse apex, strong costation, and the position of the parietal lamella in the angle at the root of the columella. It varies notably in size and contour, and in the development of internal lamellæ, of which there may be as many as three sets, or none at all. Young shells frequently show this armature, which recalls that of *Gastrodonta* or *Dibothrion*.

Figure 42 is a normal, average specimen.

Var. *desculptum* PILSBRY & VANATTA. Pl. 33, fig. 46.

Shell similar to *C. ura*, but differs in the smooth shell, lacking the strong, regular ribs characteristic of that species, or having them very few, weak and irregular.

Alt. 22, diam. 9; apert. alt.  $7\frac{1}{2}$ , width  $6\frac{1}{2}$  mill.

Alt. 19, diam. 9; apert. alt. 7, width 6 mill.

A sectionized specimen shows no internal sets of laminae, but these are frequently wanting in specimens of the typical *C. ura*. Types are from Curacao.

#### Subgenus STROPHIOPS Dall.

*Strophiods* DALL, Bull. Mus. Comp. Zool., xxv, no. 9, p. 121 (October, 1894); type "*Pupa decumana* Fér. = *C. regium* Bens.—*Maynardia* DALL, l. c. (type *S. neglecta* Mayn.).—*Seniculus* MAYNARD, Contributions to Science, III, p. 17 (1896), type *S. nympha* Brug.—*Umbonis* MAYNARD, l. c., p. 28, type *S. scalarina* Gundl.—*Pinguitia* MAYNARD, l. c., p. 30, type *S. "dimidiata"* Pfr.—*Longidens* MAYNARD, l. c., p. 39, type *S. pinnosa* Mayn.—*Multostrophia* MAYNARD, Contributions to Science, II, p. 177 (1894), type *S. eximeia* Mayn.

The parietal tooth is situated at or near the middle of the parietal wall, and may be either short or moderately long, penetrating sometimes a half-whorl inward. It is sometimes reinforced by a callous deposit or smaller tooth near its outer end on the side towards the columella, but is otherwise continuous and simple. Axial lamella deeply penetrating. The cavity of the whorls is rather ample, and not obstructed within by denticles in the adult shell. Type *C. regium* (Bens.).

It is impossible to separate the short from the long-toothed species on account of the variability of this character among species otherwise closely allied. Occasional specimens *C. glans* have the tooth as long as in the type of *Strophiodonta*, although as a general rule it is short in that species. Mr. Maynard has proposed several sectional names in this group, based upon the sculpture, etc., of the shells. These are natural groups, though of no great systematic value. They seem more distinct when only the type species is considered than when the entire series of related forms is taken into account.

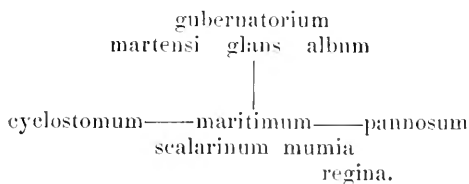
The parietal tooth or lamella is long in all of the species of Little Cayman and Cayman Brac; in *C. longidens*, *hyperbissum* and occasional specimens of *C. maritimum*, of Cuba; and in various species of the groups of *C. regina*, *C. gubernatoria*, etc. A division into long-toothed forms (*Strophiodonta*) and short-toothed (*Maynardia*), as proposed by Dall, would involve not only the separation of species otherwise closely related, but would cause embarrassment in the grouping of species with the parietal tooth of medium length, or long in some, short in other specimens. The subgenera proposed by Maynard prove to be impracticable when the whole series of species come to be classified, however distinct they may appear in the type species. I have, however, quoted them under the groups in which their types fall, though the limits Maynard would give them are quite unknown.

The shell is sculptured with fine, close rib-striae in the groups of *C. crassilabris*, *C. cyclostomum* and *C. martensi*, and in some species of the groups of *C. dimidiatum* and *C. glans*. There is of course every possible transition between the finest and coarsest sculpture, even among species of a single natural group.

Smooth species occur in the groups of *C. nra*, *pannosum*, *dimidiatum*, *regina*, *glans*, *martensi*, *anodonta* and *striatellum*, and may not unlikely be found in others. In some species, especially of the *dimidiatum* and *martensi* groups, the shell may be either ribbed or smooth.

Spiral striae are developed normally only in the group of *C. scalarinum* and some species of the group of *C. dimidiatum*.

The inter-relations of the several groups of species cannot be expressed in a linear arrangement. The following diagram shows their approximate affinities, on the supposition that *C. maritimum* represents a less differentiated form, not remote from the ancestral stock of *Strophiodonta*; each group of species being here represented by the name of a typical form.



## II. Group of *C. pannosum*.

*Longidens* MAYNARD, Contrib. to Sci. iii, p. 39, type *S. pannosa*.

All of the forms known from Little Cayman and Cayman Brac, islets which lie south of Cuba, have the parietal tooth elongated, its length about four times the height of the tooth. They are not especially related to long-toothed species of the Bahamas. The species have been absurdly over-divided.

- a.* Shell very small and slender (diam. 5-6 mill.), the whorls impressed below the suture. *nanus*, p. 183.

- a*<sup>1</sup>. Shell larger, much stouter.

- b.* Conical part of the spire ribbed, rather short.

*pannosum*, p. 184.

- b*<sup>1</sup>. Only one or two whorls of the cone, following the smooth apical whorl, ribbed (cylindric portion ribbed or smooth); the conical portion longer, more slowly tapering and acute, mainly smooth. *levigatum*, p. 189.

**C. NANUS** (Maynard). Pl. 27, figs. 1, 2, 3.

Shell small, cylindric or tapering, rather thin, dirty white, flesh-tinted at the apex and where worn. Whorls  $8\frac{1}{2}$ – $10\frac{1}{2}$ , the earlier  $2\frac{1}{2}$  corneous or fleshy, nearly smooth, those following ribbed, the ribs rather narrow, 19–23 in number on the penult whorl. The later 3 or 4 whorls are constricted below the sutures, then convex. Umbilical chink short. Aperture ovate or rounded-ovate, brownish inside; lip flatly but narrowly reflexed, thickened within; parietal callus strong. Parietal lamella rather strong, fully one-third of a whorl long. Axial lamella very weak, hardly noticeable from the aperture.

Length 17, diam. 5, length of aperture 4.8 mill.

Length 15.5, diam. 6, length of aperture 5.7 mill. (typical).

Length 13, diam. 5, length of aperture, 4.8 mill.

*Little Cayman Island.*

*Strophia nana* MAYN., Contrib. to Sci. i, p. 27, pl. 2, f. 11, a, b, c. (1889).—*Cerion nanum* PILS. & VAN., P. A. N. S. 1896, p. 318.

Varies in degree of elongation, and in the form, which may be either cylindrical or more or less tapering from the last whorl upwards. Rarely the riblets are very weak and irregularly developed. Maynard states that the ribs of the last whorl vary from 16 to 20 in number.

*C. nanus* occurs, according to Maynard, "in a space which is only five or six yards wide by twenty long, on this little key, and as they were rigidly confined to this narrow area, which on a good sized chart of the West Indies would be more than covered by the point of a fine cambric needle, I consider that this species has the most restricted range of any animal with which I am acquainted. This spot is on the west end of Little Cayman, on the easternmost of the two paths that cross the key, near their junction.

"In habit, this species is social, and I found many of them clinging to a kind of heath-like plant which was about eighteen inches high, and which had small grey leaves of nearly the same color as the shells, and which on being crushed, gave out a strong odor. Here these Strophias were exposed to the burning rays of a nearly vertical sun, and the heat in which they lived during the day was intense. Some, perhaps one-third of them, had retreated beneath stones, a situation in which it is rare to find a Strophia, the only other species that I have found in a similar situation, being *S. incana* from Key West, which retreated from the cold of winter, and one other species occurring in the pine wood on the island of New Providence, to be mentioned later. It is evident that in this species, we have a Strophia dwarfed to an extreme degree, from feeding on the pungent leaves of the plant described, and isolated as it is by surrounding areas of rough, jagged rocks, the process of diminution has gone as far as it can go and allow the animal to live as a Strophia, with the ordinary habits of Strophia. The ground was strewn with thousands of dead shells, showing that mortality among them was great." (Maynard.)

*C. PANNOSUM* (Maynard). Pl. 27, figs. 4, 5, 6.

Shell perforate and shortly rimate, oblong or subcylindric, solid and strong; white, or sometimes bluish or fleshy white, uniform or faintly flecked with flesh color above. Whorls about 11, slightly convex, the last three of about equal diameter, or the penultimate may be wider; those earlier forming a straight-sided cone. Last



whorl usually rather compressed and tapering below, ascending in front. Sculpture of moderately strong ribs, which are nearly regular on the cone, but *widely and more or less irregularly spaced on the last three whorls*, about 16–20 in number on the penult. whorl. Aperture ovate, purplish-brown in the throat; peristome flesh-tinted, reflexed, usually *very much thickened beyond the reflection*; parietal margin heavily calloused, often forming a narrow ridge. Parietal lamella strong and about a third of a whorl long. Axial lamella strong, ascending about one whorl.

Length 27, diam.  $12\frac{1}{2}$ , length of aperture 12 mill.

Length 28, diam. 13, length of aperture  $11\frac{1}{2}$  mill.

Length 31, diam. 13, length of aperture  $12\frac{1}{2}$  mill.

*Little Cayman Island*, on the west end.

*Strophia pannosa* MAYN., Contrib. to Sci. i, p. 10, pl. 1, f. 5, 6, 13 (anat.), pl. 2, f. 1, *b*, *c*.—*C. pannosum* PILS. & VAN., P. A. N. S. 1896, p. 319.—*Strophia fusca* MAYN., t. c., p. 77, fig. 12, repeated on pl. 7, f. 19, 19*a* (July, 1889).—*Strophia intermedia* MAYN., t. c., p. 13, pl. 2, f. 3, 3*b* (April, 1889).—*Strophia copia* MAYN., t. c., p. 22, pl. 1, f. 1, 3, 7–12 (anatomy); pl. 2, f. 8, 8*b* (shell).—*Strophia perplexa* MAYN., t. c., p. 71, fig. 7, pl. 7, f. 15, 15*a*.—*Strophia glaber* MAYN., t. c., p. 25, pl. 2, f. 10, 10*b*.—*Strophia parva* MAYN., t. c., p. 24, pl. 2, f. 9, 9*b*.—*S. lineata* MAYN., t. c., p. 20, pl. 2, f. 7, 7*b*.

This is the largest *Cerion* of the Cayman Islands. The types measure  $31.8 \times 14.2$ , and  $30.8 \times 12.5$  mill. The typical form may be known by the irregular, rather wide-spaced riblets. It varies from a subcylindric to an almost oval form. Mr. Maynard writes: "The Ragged *Strophia* occurs on the west end of the island of Little Cayman, living on the coarse vegetation which grows among the rocks that lie just above the beach. I have never found them east of the little cove, on the north side, called Bloody Bay, where the rocks of what is known as the Iron Shore terminate, nor east of the few houses which constitute the only settlement on the key on the south side; thus they occupy a line, somewhat broken, of a few yards in width and about three miles long. This narrow strip was occupied by them almost exclusively, inasmuch so that out of three hundred *Strophias* that I gathered in a two-mile walk, twelve only were of another species (*S. levigata*).

"In habit they differ from many of the species occurring on the

Caymans, in being rather solitary, at best only a dozen or so being found together, consequently they were not abundant. At the time of my visit, the last week in April, the weather was mainly dry, and they were clinging to the low, stunted plants, or to rocks, and not feeding." (Maynard.)

As usual in *Cerion*, the sculpture, color and size vary within wide limits, and there is complete intergradation of the forms, although a typical form prevails in any given local colony. The following have been named:

- a. Ribs irregularly and widely spaced on the last 3 whorls.
  - b. Large and stout, about 28x13 mill., whitish, *pannosum*.  
Variegated, 31x11 mill., *fuscum*.
  - b<sup>1</sup>. Smaller, about 22x10 mill., whitish, *intermedium*.
- a<sup>1</sup>. Ribs regular or nearly so, 21-27 on penult. whorl.
  - b. Ribs 22-27; shell whitish, about 23x10 mill., *copia*.
  - b<sup>1</sup>. Ribs 25-27; white with purple-brown intervals; 24x10 mill., *lineatum*.
  - b<sup>2</sup>. Ribs 21-25; shell whitish, 15-17x7½ mill., *parvum*.
- a<sup>2</sup>. Ribs subobsolete on the later whorls.
  - b. Shell whitish, about 22½x10 mill.; cone rather acute, *perplexum*.
  - b<sup>1</sup>. Shell whitish, about 16x7½ mill., *glaber*.

Color-form *fuscum* Mayn. (pl. 27, figs. 7, 8, 9). A form of *C. pannosum* has been called *Strophia fusca* by Mr. Maynard. It is dull purple with the riblets mainly white, fading to light reddish-brown above. Length 26½, diam. 12 mill. Maynard's type measured 31.2x11.2 mill.; and he gives the variation as from 33.7x13.7 to 22.5x10.5 mm. As in *pannosum*, the riblets are rather wide-spaced. It occurred "on the west end of Little Cayman, low down in the thick scrub. They are quite solitary in habit, and rather rare." Figs. 7, 8 are copied from Maynard.

Form *intermedium* Maynard. (Pl. 27, figs. 10, 11, 12.)

Smaller than *C. pannosum*, but similar in the white or bluish-white color with few darker flecks above, or none, and in the rather wide-spaced, often irregular costation, there being about 17-19 ribs on the penult. whorl. The aperture is either dark in the throat, or throughout, the lip in the latter case being brown-tinted. Peristome usually thickened less than in *pannosum*. Length 21.5, diam. 10 mill.; length 24, diam. 11.3 mill.; the types 22.5x10, and 22x10 mill.

It "is found on the coast of the south side of Little Cayman, west of the large mangrove swamp that nearly divides the island into two unequal portions, and along the beach on the south side of Cayman Brae, as far east as the cocoanut grove extends, now about half the length of the key." They mingle occasionally with colonies of *C. copia* that border the shore, and are never found far from the beach.

Form *copia* Maynard. (Pl. 27, fig. 13.) A solid white form, sometimes bluish or pink tinted, and rarely maculate with flesh-color, having 10 whorls, and rather strong, nearly regular riblets, usually 22-27 on the penult. whorl, though in some specimens the number falls to 17. Peristome moderately, or sometimes heavily, thickened, usually fleshy or yellowish. Teeth strong and long, as in typical *C. pannosum*. Types measure 22.5x10, and 23.7x10 mill. Varies from 27x11.3 to 19x8 mill.

Maynard writes: "I do not remember ever having seen any species of land shell more abundant than this species of *Strophia*. In the shrubbery that bordered the paths and roads about the west end of Cayman Brae, they were common, clinging to the base of the bushes in masses, but their stronghold was the cocoanut grove on the south shore of the key, just opposite the few houses at the west end; here they absolutely swarmed in certain spots. Not only was the low herbage covered with them, but they fairly whitened the bases of the stems of the cocoanut trees, and often accumulated in such numbers on the small stumps that they clung on top of one another, often three or four deep, and could be gathered by the double handfuls. As the weather was mostly dry, they did not move much, so I could not decide upon what plant they fed, but judging from their numbers, this food plant must have been abundant, and by cultivation of the soil, the *Strophias* were placed under favorable circumstances for the increase of the species. Through the agency of man, three or four other species had been introduced into this large colony, which occupied in all about a half a square mile of country." (*Maynard*.)

This form is hardly distinguishable from *C. pannosum* form *intermedium* except by the more numerous riblets, a character subject to some variation, one lot received from Mr. Maynard comprising specimens with 27, 24 and 17 riblets on the penult. whorl; the smallest number being due to the absence of several ribs, as well as the wider spacing of the others. The larger specimens have 11 whorls. The name was ill-chosen, and should have been "*S. copiosa*"

Form *parvum* Maynard. (Pl. 27, fig. 14.) Smaller than form *copia*, but similar in form and sculpture, the costation being strong and regular, 21-23 riblets on the penult. whorl. Whorls  $9\frac{1}{2}$ . Bluish-white, sometimes mottled with flesh color above. Length 15-17, diam. 7.5 mill. Varying from 18 to 15 mill. long.

"This species occurs in a very limited area, on the west end of Cayman Brac. Near the northern termination of a path that crosses the key near the western end, is a strip of quite high shrubbery, and in this these *Strophias* lived. From this point, they were scattered at intervals, quite into the large colony of common *Strophias*, in the cocoa-nut grove on the south side, having evidently been inadvertently transported by the inhabitants." (*Maynard*.)

Form *lineotum* Maynard. (Pl. 27, fig. 15.) Similar to form *copia*, in size and shape, or a little stouter. *Closely and regularly ribbed throughout, the ribs white, intervals in part or wholly purple-brown.* There are about 25-27 ribs on the penult. whorl, about as wide as the interstices. The peristome is only moderately thickened, and the parietal callus is thinner than usual in this species. Teeth long. Types measure 26x10 and 24.5x10.5 mill. It varies from 27.5 to 18.5 mill. long.

Found by Mr. Maynard "in a small cocoanut grove on the south side of Little Cayman, near the east end, and more rarely in the cocoanut grove near the boat landing, on the south side of Cayman Brac. This spot on Little Cayman, about a half acre, was occupied by them exclusively, while on the other Key they mingled with the Common *Strophias*. They were probably transported from one place to the other by boat, the original locality, probably, being Little Cayman. The cocoanut grove where I found these *Strophias* was situated directly on the shore, some miles from any settlement, and was completely isolated from all other colonies of *Strophia*. The width of the Key intervened between this point and a colony of *S. copia* on the north shore, two miles, at least, of nearly naked, jagged rocks, as impassable to a mollusk of this species as would be the wide Atlantic, and there was no vegetation in this direction, to induce them to extend their colony, and between them and the several species that occupied the west end of the island were miles of rocky country and the mangrove swamp. I found them very abundant, clinging to the fallen cocoanut leaves and other debris that lay upon the ground. They were gathered in close clusters of many individuals, often on top of one another." (*Maynard*.)

Form *perplexum* Maynard. (Pl. 27, fig. 16.) Form and size of *copia*, or with the cone of the spire longer, approaching *acutum*. Pinkish or bluish white, sometimes indistinctly maculate with fleshy above; the aperture brown, peristome strongly thickened and tinted. Terminal cone rather regularly and finely ribbed, but *on the cylindrical portion the riblets are small and low, irregularly developed and widely, unevenly spaced*, becoming stronger on the latter half of the last whorl. Whorls 10–11. Length 22.5, diam. 10 (type), but varying from 25 to 19.5 mill. long.

This form differs from *intermedium* and *copia* by its more or less subobsolete riblets. In *acutum* the spire is more tapering and acute. Maynard writes that *perplexum* occurs on the island of Cayman Brac, in a "barren rocky section, about two miles from the west end of the Key, and a quarter of a mile from the south shore. They were restricted to a very limited area, and I found them clinging to low herbage or to the naked rock, in almost every instance exposed to the burning rays of a tropical sun."

Form *glaber* Maynard. (Pl. 27, figs. 17, 18.) Much smaller than form *perplexum*, but like it in having the terminal cone costellate and the cylindrical portion nearly smooth, or with only low, irregular subobsolete riblets. Bluish-white, with abraded patches of brownish or purplish-brown. Whorls 9 to nearly 10. Peristome thick, pale. Length 15.5, diam. 8.2; length 16.2, diam. 7.5 mill.; varying from 22 to 15 mill. long. This is merely a colony of dwarf *perplexum*, just as *parvum* is dwarf *copia*. Sixteen specimens were taken. Maynard writes: "I found this species very rare on the margin of the path near the area occupied by *S. parva* (on the west end of Cayman Brac near the northern terminus of the path that crosses the key near the houses). They were rather solitary in habit, and occurred on the low herbage which offered them an opportunity for concealment."

C. LEVIGATUM Maynard. Pl. 27, figs. 19, 20.

Shell perforate and rimate, oblong-cylindric, strong and solid; whitish, more or less stained with blue or livid flesh-color; whorls 10–11, flat. Nepionic shell of  $2\frac{1}{2}$  whorls, the first  $1\frac{1}{2}$  smooth, next whorl narrower, finely striate; *the succeeding whorl (first post-nepionic whorl) ribbed*. The rest of the whorls, except the last, are *nearly smooth*, marked by slight wrinkles and occasional faint indications of

riblets; last whorl more or less tapering below, ascending in front, *its last half sculptured with rather strong, narrow, widely-spaced ribs*, narrower and often doubled in number at the base. *Cone of the spire rather long* and tapering. Aperture rounded-ovate, brown in the throat, the lip and teeth ivory-white. Peristome flanged and very heavily thickened; parietal callus strong. Parietal and axial lamellae strong and long.

Length 31.2, diam. 13 mill.; length 27.7, diam. 12 mill. (types).

Length 33.5, diam. 13.7 mill.; length 26.5, diam. 11.7 mill.

Length 28, diam. 12.7 (average shell).

*Little Cayman Island*, west end.

*Strophia levigata* MAYN., Contrib. to Sci. i, p. 12, pl. 2, f. 2, 2 *b* (April, 1889).—*C. levigatum* P. & V., Proc. A. N. S. P., 1896, p. 319.—*S. festiva* MAYN., t. c., p. 17, pl. 2, f. 5, 5 *b*, 5 *c*.—*S. nitela* MAYN., t. c., p. 73, f. 8, pl. 7, f. 16, 16 *a*.—*S. acuta* MAYN., t. c., p. 15, pl. 2, f. 4, 4 *b*.—*S. picta* MAYN., t. c., p. 18, pl. 2, f. 6, 6 *b*.

This species is separated from *C. pannosum* in its various forms by the longer, more tapering cone of the spire, its smoothness, only the first post-nepionic whorl being costulate, the latter half of the last whorl again becoming more or less ribbed. In *pannosum* the whole cone of the spire is ribbed, even when the cylindrical portion is smooth, and it tapers more abruptly above, producing a shorter, blunter cone.

The above description, apart from these characters, applies to typical *levigatum* only. The several colonies of the species, though all within a radius of a few miles, show local differentiation in size and coloration, as noticed below.

Typical *levigatum* "occurs on the west end of Little Cayman Island, very sparingly on the coast, and rather more commonly among the low growth of trees in the interior." They occupy an extent of country about 3 miles long and a mile wide. Specimens occur in groups of 4 or 5 individuals, scattered at rather wide intervals along the two paths that cross the key.

Color-form *festivum* Maynard (Pl. 27, fig. 21). Similar to *levigatum*, but white, copiously maculate longitudinally with brown above, gray and brown below. 30x12.5 mill.; 27.5x12.5 mill. This is merely a mottled form of *levigatum*, probably not in any sense a race. It occurred on the borders of two small fields or cultivated areas, of perhaps a quarter of an acre each, on the western path

across Little Cayman, hardly a half mile from the northern shore. 22 specimens found.

Form *nitela* Maynard (Pl. 27, figs. 22, 23). Shell strong, decidedly smaller and more slender than typical *levigatum*, blue-stained white. Smooth or nearly so, except at the base, which is sometimes rather sharply but delicately ribbed. Post-nepionic whorl sometimes hardly costulate. Length 27.5, diam. 12.5 (type). Varies from 28 to hardly 25 mill. long. Slightly stouter and less tapering above than form *acutum*, but there is perfect intergradation between them; this form in fact connecting typical *levigatum* with *acutum*.

This form occurred in numbers in exposed situations in patches of Guinea grass growing on the margins of the path that crosses the west end of Little Cayman. They were clinging to the grass stems, at the roots of which lay hundreds of dead specimens. They appeared to be restricted to two or three of these small clearings.

Form *acutum* Maynard. (Pl. 27, fig. 24.) Somewhat smaller and more slender than form *nitela*, and nearly smooth, though a few irregular riblets usually appear on the latter part of the last whorl. Blue-stained white, often indistinctly mottled with flesh-color on the cone, sometimes having worn patches of livid brown. *Spire slowly tapering, acute, the conic portion long*, including all but the last or last two whorls. Length 23.5, diam. 9.5-10 mill. (type); varies from 24.2 to 20 mill. long.

This form was found by Mr. Maynard in numbers on bushes growing on the south side of a little open patch of ground, on the western path across Little Cayman, near its junction with the other path a few hundred yards from the south shore. The entire space occupied by the shells did not exceed a quarter of an acre in extent, and the form was not found elsewhere. It is, however, the slightest modification of form *nitela*.

Form *pictum* Maynard. (Pl. 27, figs. 25, 26.) Similar to forms *nitela* and *acutum*, but copiously variegated with dull purple or purple-brown; peristome less thickened, nearly smooth, except for sharp riblets at the base and sometimes behind the outer lip. Length of types 24x10 and 21.5x9.7 mill. Varies from 26 to 21 mill. long. This is a variegated form of the *nitela-acutum* type, as form *festivum* is of typical *levigatum*. It occurred around open spots in the Guinea grass, near the southern end of the western path across Little Cayman.

III. *Group of C. crassilabris.*

Shell cylindric to oval, sculptured with numerous close ribs or rib-striae. Parietal tooth short, at the middle of the parietal wall. The species are distributed as follows:

Guiana: *C. antoni*, p. 192.

St. Croix: *C. rude*, p. 193.

Porto Rico and the Virgin Is.: *C. crassilabris*, p. 192.

Haiti: *C. yumaense*, with varieties *ferrugineum* and *sallei*.

Grand Cayman Island: *C. caymanense*, p. 196.

The forms are closely related to the Cuban group of *C. cyclostoma*, being separated here merely on account of the different distribution.

*C. ANTONII* (Küster). Pl. 32, figs. 39, 40.

Shell ovate-cylindric, umbilicate, a little shining, the spire obtuse; regularly striate and sulcate; rose-white; whorls 9, the suture simple. Aperture ovate-rounded, with two folds; peristome sub-labiate. Length 16, diam. nearly 8 mill. (*Küster*).

*Berbice*, British Guiana (*Anton* coll.).

*Pupa antonii* KUESTER, *Conchyl. Cab.* p. 92, pl. 10, f. 7, 8.—*PFR.*, *Monogr.* iii, p. 539.

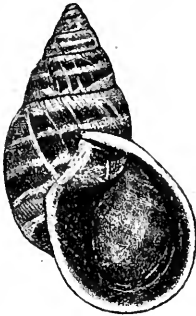
The shell is thin, translucent, ovate-cylindric, very blunt-pointed, with a short umbilical fissure and deep but narrow umbilicus; it is rose-reddish white. The suture rises high toward the aperture. Aperture white, yellow-reddish within. There is an oblique fold on the parietal wall, and a second almost horizontal one on the columella. Peristome hardly expanded, nearly straight, a little thickened.

The above details and the figures are from Küster. The species has not been seen, apparently, by any other author. On account of its anomalous location, far out of the range of the rest of the genus, it becomes of unusual interest. There is, of course, a possibility of mistake about the locality.

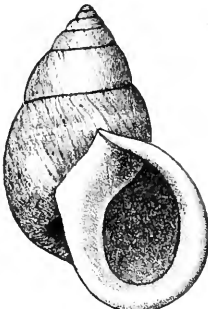
*C. CRASSILABRIS* ('Shuttlw.' Sowb.) Pl. 33, figs. 47-52.

Shell deeply rimate, oblong, solid and strong, varying in color from (a) white with some fleshy maculation above, the apical whorls corneous, to (b) angularly streaked and maculate throughout with dull dark brown or fleshy, or (c) purplish brown with white rib-striae. Form somewhat cylindric, the last two, sometimes three whorls of equal diameter, the rest slowly tapering. *Apex excessively*

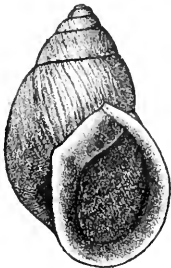




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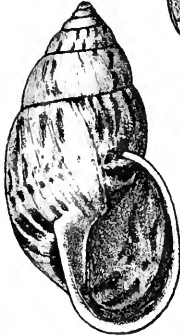
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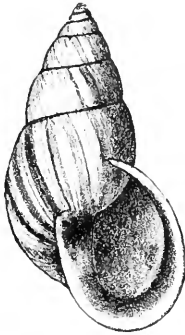
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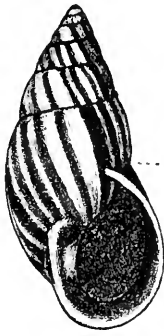
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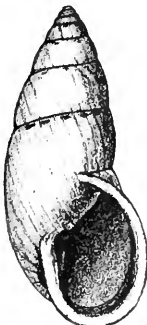
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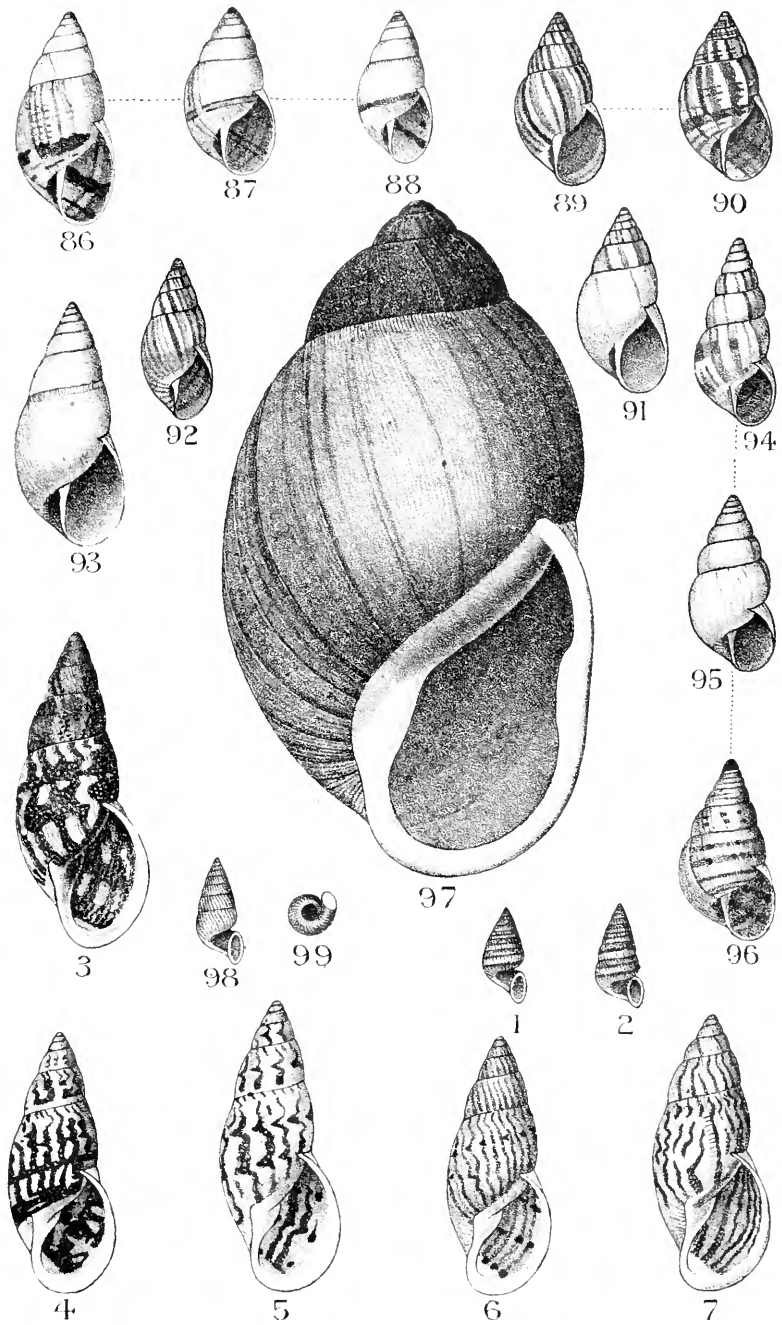


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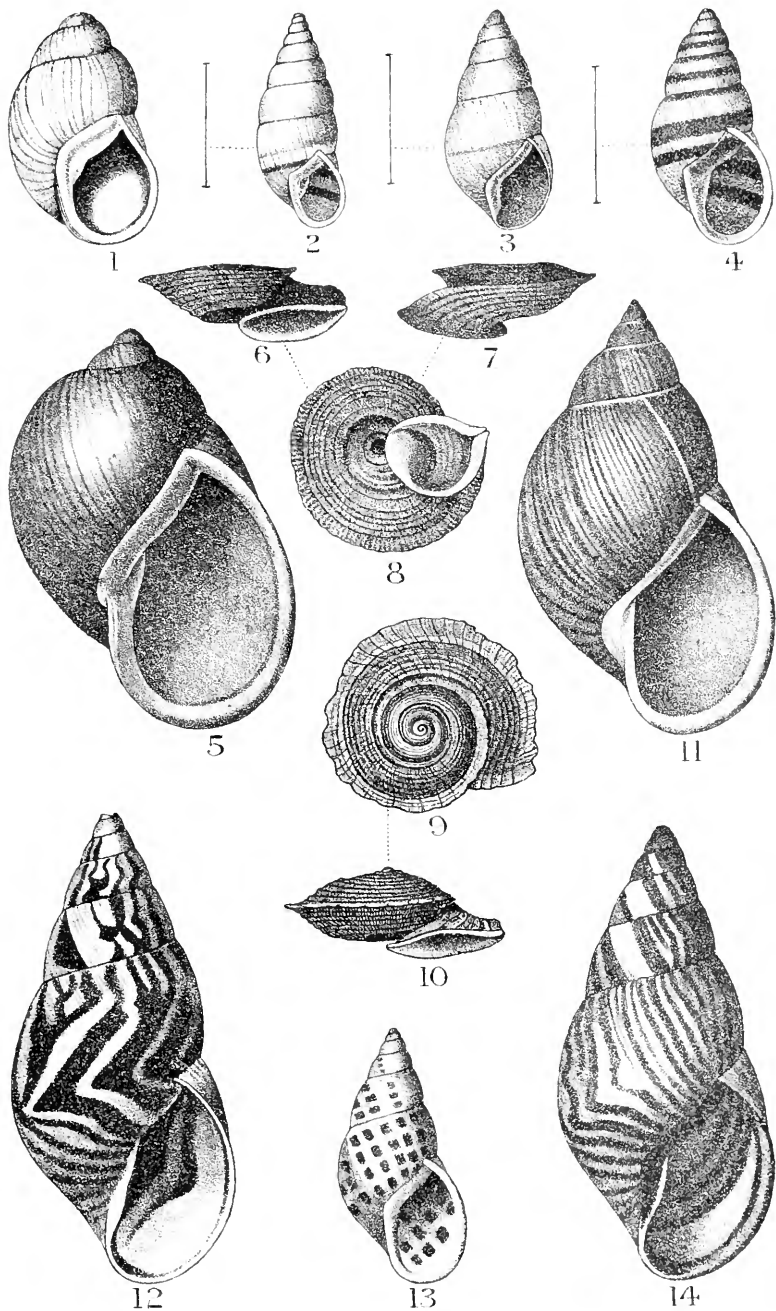


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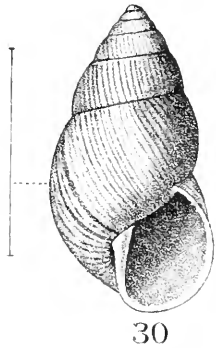
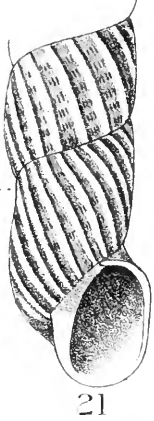
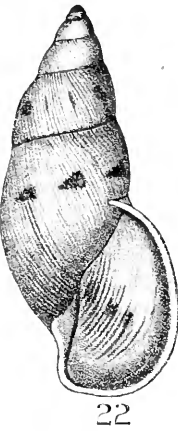


















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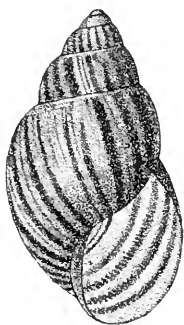
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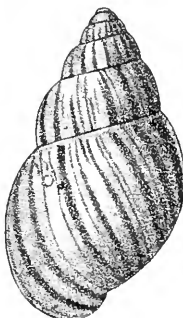
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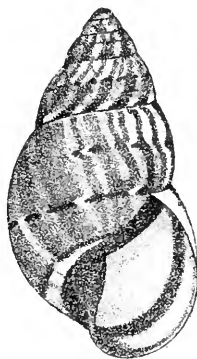
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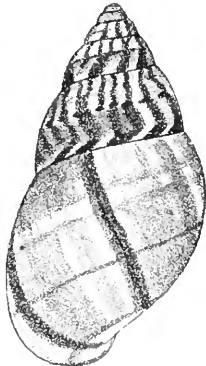
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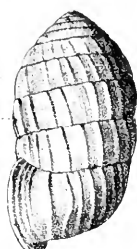




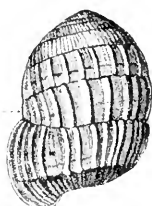




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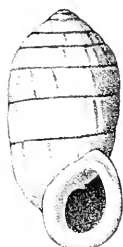
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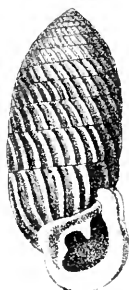
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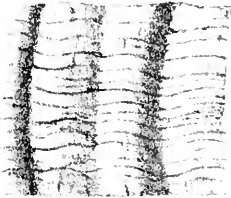
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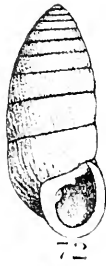
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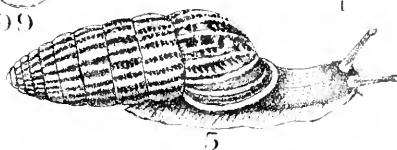
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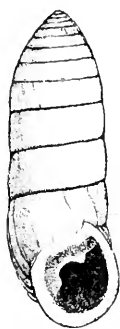
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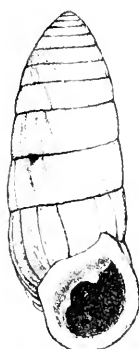
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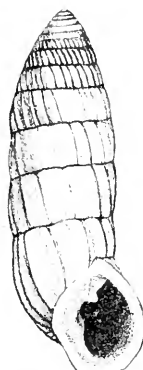
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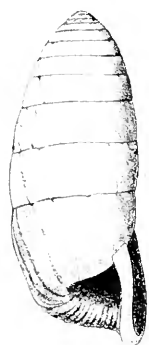


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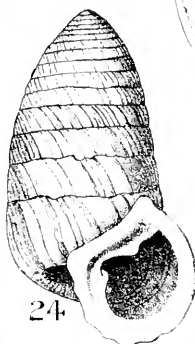
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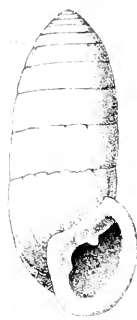
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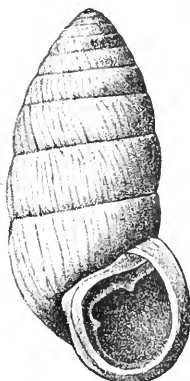
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*obtuse*. Whorls  $10\frac{1}{2}$  or fewer, but slightly convex, *evenly sculptured with fine riblets or rib-striæ*, about 45 on the penult. whorl in large specimens. Aperture truncate-ovate, flesh or brown tinted within; peristome narrowly reflexed, convex, often strongly thickened; parietal lamella rather short; axial lamella rather acute. Parietal callus usually rather thin and transparent.

Length 27, diam.  $11\frac{1}{2}$  mill.

Length 30, diam. 11 mill.

Length  $19\frac{1}{2}$ , diam.  $9\frac{1}{2}$  mill.

Porto Rico: *Ponce* (typical form, R. Swift). Virgin Islands: *Anagada* (Swift) and *Necker Island*, near Virgin Gorda (Dr. Cleve).

*Pupa crassilabris* Shuttleworth MS., SOWERBY, *Conch. Icon.*, xx, pl. 2, f. 14 (May, 1875).—*Pupa striatella* Fér., KUSTER, *Conch. Cab.*, p. 91, pl. 10, f. 14, 15; SOWERBY, t. c. pl. 3, f. 18 *a, b*.—*Pupa microstoma* var.  $\gamma$  PFR., *Mal. Bl.*, 1852, p. 208; *Monogr.*, iv, p. 660.

This species is quite distinct by its exceedingly obtuse apex. Figures 50–52 represent specimens from Ponce, Porto Rico, the larger ones being typical.

On Necker Island the shells are white. On Anagada they are small, rather egg-shaped, and vary from white to copiously marked (pl. 33, figs. 47–49). Specimens measure: length  $23\frac{1}{2}$ , diam.  $9\frac{1}{2}$  mill.;  $20 \times 10$ ;  $18 \times 9\frac{1}{2}$ . The last measurements are of a specimen with  $8\frac{1}{2}$  whorls, with about 65 rib-striæ on the penultimate whorl.

Some specimens in the collection before me are marked "San Domingo" and "Cuba," but I have little doubt that these data are incorrect. The species has been commonly named "*P. striatella*" in collections. It differs decidedly from the original figure of that species in the much more obtuse apex.

In the type specimen (pl. 60, fig. 22) the lip is somewhat thicker than in most shells I have seen, but the general form, very obtuse apex, sculpture and color are the same. A tray of the specimens before me was labelled by Shuttleworth. The original description is as follows: "Shell subcylindrical, obtuse, pinky-whitish, clouded with brown, finely ribbed; aperture somewhat auriform, two-plaited, margin doubled."

Sowerby's figure of *Pupa antoni* (C. *Icon.*, f. 9) looks like *crassilabre*.

C. RUDE (Pfeiffer). Pl. 33, figs. 54, 55, 56, 57.

Shell rimate and perforate, solid, cylindric or cylindric oval; surface whitish or yellowish, chalky, the specimens being fossil; sculptured with many rather narrow somewhat oblique riblets, 30 to 32 on the last whorl, usually narrower than the intervals. Whorls 10 to  $11\frac{1}{2}$ , but slightly convex. Apex obtuse, the terminal cone with convex outlines. Aperture truncate-rounded, the parietal lamella well developed, usually rather short, axial lamella distinct; peristome expanded and reflexed, thickened within.

Length 30, diam. 12 mill. (type of *rude*).

Length 29 to 34, diam. 13 mill.

Length 21, diam.  $10\frac{1}{2}$  mill.

Length 25, diam. 12 mill. (type of *latilabris*).

Length 23, diam.  $11\frac{1}{2}$  mill.

St. Croix: on the plantations "*Diamond*," "*Paradise*" and "*Blessing*," as a quaternary fossil (Riise).

*Pupa rudis* PFR., Mal. Bl. ii, 1855, p. 102, pl. 5, f. 1, 2; Monogr., iv, p. 657.—SOWB., C. Icon., pl. 3, f. 21 (*bad*).—*Pupa latilabris* PFR., t. c. p. 103, pl. 5, f. 3.

This species has not been found living, but occurs in abundance as a fossil. *P. latilabris* Pfr. (fig. 53) is merely a short specimen, not varietyally different. While obtuse at the apex, this species is far less so than *C. crassilabre*.

C. YUMAENSE Pilsbry and Vanatta. Pl. 33, fig. 58.

Shell cylindrical, the lower three whorls of about equal diameter, those above tapering rapidly to form a short cone. White, mottled with fleshy-corneous above, or having this or a darker color appearing in sparse streaks, or in most or all the intervals between the opaque white riblets, throughout the shell. Surface evenly, regularly and closely ribbed, the ribs rounded, about as wide as their intervals, usually about 32, but varying from 29 to 37 in number on the penult. whorl. Whorls  $9\frac{1}{2}$ , the earlier two corneous, first one smooth, next very minutely radially striate. Last whorl rounded below. Umbilical chink much compressed, the tract below it semi-lunar, defined by a groove. Aperture truncate-ovate, brown within; parietal lamella small, short. Columella truncated obliquely; lip rather narrowly expanded, not thickened; the parietal callus thin.

Length  $24\frac{1}{2}$  to 26, diam.  $9\frac{1}{2}$  mill.



Length 21, diam.  $9\frac{1}{2}$  mill.

San Domingo: (Gabb, Sallé); Haiti: *Yuma* (H. Prime); near *Jeremie*, *Cote de Fer* (Maynard).

*C. (Maynardia) yumaensis* P. & V., New species of the genus *Cerion*, p. 5 (May 4, 1895); P. A. N. S., 1895, p. 210 (June 18); P. A. N. S., 1896, p. 324, pl. 11, f. 2, 3.—*Strophia ferruginea* MAYNARD, Contrib. to Science, iii, p. 19, pl. 4, f. 5, 6 (March, 1896).

This Haitian form differs from *C. crassilabre* by its coarser sculpture and less rounded apex. It is not like any Cuban species. The specimens before me from Gabb and Sallé were apparently collected in the San Domingo part of the island. The types, a large series from Henry Prime, are labelled "*Yuma*, Haiti"—a place I have not found on maps at my command. I formerly thought it might be *Yuma* River, but this is in S. Domingo, and my label is clearly *Yuma*.

Var. *ferrugineum* Maynard. (Pl. 33, fig. 59). Rusty-red, the riblets white, whorls 9. Riblets less numerous than in typical *yumaense*, 26 on the last whorl. Teeth moderately developed. Size varies from  $22\frac{1}{2}$  mill. long, 10 wide, to  $19\frac{1}{2} \times 9\frac{1}{4}$  mill. The types are from "near *Jeremie*, *Cote de Fer*."

Var. *sallei* Pils. and Van. (Pl. 33, fig. 61.) Shell much smaller, cylindric, white or cream-white, more or less maculate on the cone with purplish or fleshy. Whorls 9– $9\frac{1}{2}$ , but slightly convex. Terminal cone with convex outlines, the apex obtuse. Sculpture of close, fine riblets, 40 to 44 on the penult. whorl, separated by intervals of about the width of the riblets. Aperture ovate, brown or ochre-brown inside, fading to white at the lip; parietal lamella small and rather short, axial lamella small. Length 19, diam.  $7\frac{1}{2}$  mill.

*San Domingo* (Sallé).

*Cerion crassilabre sallei* PILS. and VAN., Proc. A. N. S., Phila., 1896, p. 325, pl. 11, f. 6.—*Pupa striatella* var. *minor*, KUESTER, Conchyl. Cab., p. 92, pl. 11, f. 13–15.

Formerly referred to *C. crassilabre*, but it seems to be more closely related to *yumaense*, differing chiefly in the smaller size and more numerous, finer riblets.

With the type lot of *C. yumaense* there were many specimens of a smaller, fine-ribbed form, which seems referable to *sallei*. The shells vary a good deal in contour, and are white except for some maculation near the apex; riblets 35 to 38 on the penult. whorl; whorls  $8\frac{3}{4}$  to  $9\frac{1}{2}$ . The parietal lamella varies from as well developed as in *C. sallei* to subobsolete or wholly wanting.

Length  $16\frac{1}{2}$ –18, diam.  $7\frac{1}{2}$  mill.

Length 13, diam. 7 mill. (shortest specimen).

In a large quantity of specimens examined there are no intergrades with *yumaense*. As in that species, the young shells are without teeth, other than a small axial fold. One of the Yuma specimens is figured (fig. 60).

C. CAYMANENSE n. sp. Pl. 44, figs. 85, 86.

Shell shortly rimate, cylindric with rather straightly conic terminal cone and obtuse apex; solid and strong, grayish-white, very sparsely flecked with dull purple, generally more copiously marked on the cone. Sculpture of regular, crowded riblets, somewhat wider than their intervals, 25 to 28 on the penultimate whorl, *each rib a little swollen at the upper end*, crenulating the sutures. Whorls  $8\frac{1}{2}$  to  $9\frac{1}{2}$ , but slightly convex, the last ascending in front. Aperture ochre brown inside; peristome whitish, somewhat reflexed, thick; parietal callus moderately heavy, appressed. Parietal tooth small and very short; axial tooth small.

Length 19, diam. 8 mill.

Length 17.3, diam. 7.6 mill.

*Grand Cayman Island* (C. B. Taylor).

This species resembles *C. yumaense* var. *sallei* of S. Domingo, but its apex is less obtuse, the peristome much thicker, and the ribs stouter. The specimens described were received from Mr. G. H. Clapp, and collected by Mr. C. B. Taylor, of Kingston, Jamaica, who found them on a "honeycomb" lime rock and red earth formation, on the north side of the island.

#### IV. Group of *C. cyclostomum*.

Fine-ribbed or striate and rather small species, with the parietal tooth short and central, sometimes obsolete. All are from Cuba, occurring the whole length of the island. The species are difficult to discriminate.

C. CYCLOSTOMUM (Küster). Pl. 32, figs. 13, 14.

Shell ovate, cylindric, less rapidly tapering above than *uva*, and less tapering below, rather thin, glossy. The apex is smooth, the rest of the surface sculptured with *very numerous, fine, somewhat acute riblets, separated by intervals of the same width*. On the upper

whorls the riblets are somewhat arcuate and oblique, but become straight on the lower ones. Whorls 10, very narrow, but slightly convex, separated by a simple, impressed suture. *Aperture almost circular*, with a strong fold on the parietal wall and a smaller one on the columella. Peristome continuous, with thick, reflexed outer lip. *Yellowish-white, with pale reddish-yellow, irregular markings*, chiefly confined to the interstices; the aperture pale yellowish. Length 9, width  $3\frac{2}{3}$  lines ( $18 \times 7\frac{1}{3}$  mill.). (*Kuester.*)

*Locality unknown*; type in coll. K. University of Erlangen (Kuester). Cuba: *Cayo Frances* (Gundlach).

*Pupa cyclostoma* KUESTER, Conchyl. Cab., p. 6, pl. 1, f. 5, 6.—PFR., Monogr., ii, p. 316.—ARANGO, Fauna, p. 102.

This species is the senior member of a group of closely related forms which have not been satisfactorily discriminated, and more ample material with exact locality data must be had before they can be understood. Under the circumstances I consider it best to give the original descriptions and copies of the original figures. The italics are my own.

Shells which seem to me referable to *C. cyclostomum* are before me from Cabo San Antonio, the western extremity of Cuba, sent by R. Arango, have a heavily calloused parietal wall, with small and short parietal lamella. The aperture is white or nearly so within, and the reflexed lip is thickened. There are 29 to 31 rounded riblets, as wide as their intervals, on the penultimate whorl. One of these specimens is figured on plate 32, fig. 19.

Var. *KUSTERI* (Pfeiffer). Pl. 32, figs. 15, 16, 17, 18.

Shell deeply and shortly rimate, ovate conic, somewhat solid, regularly ribbed with rather close riblets, thickened at the sutures; whitish, streaked and marbled with pale corneous. Spire swollen in the middle, then regularly tapering in a somewhat obtuse cone. Whorls  $8\frac{1}{2}$ , a little flattened, the last about two-fifths the total length, somewhat ascending in front, the base slightly compressed. Aperture slightly oblique, semi-oval, with parietal and columellar folds; peristome narrowly expanded, the margins joined by a thin callus. Length 12, diam. above the middle 6 mill. (*Pfr.*).

*Habitat unknown.*

*Pupa küsteri* PFR., P. Z. S., 1852, p. 69, no. 61; Monogr., iii, p. 540.—KUESTER, Conchyl. Cab., p. 165, pl. 20, f. 3-6.

A very small form, which Pfeiffer subsequently reduced to varietal place under *cyclostoma*, remarking that intermediate forms exist. The original description and figures are given.

C. PINERIA Dall. Pl. 32, fig. 20.

Shell small, whitish, obliquely mottled with pale brownish flammules, sometimes nearly all brownish, with about eight whorls; nucleus smooth, brownish, of a whorl and a half, followed by fine, narrow, oblique, subequal riblets crossing the whorl, with about equal interspaces; apex dome-shaped; body of the shell subcylindrical, base slightly attenuated, with no umbilicus; aperture rounded, except over the body, with a thick, white, well-reflected lip, parietal and pillar lips each with a low median tubercle or tooth. Length 14, diam. 6.5 mill. (Dall).

*Isle of Pines* (Johnson).

*Cerion* (*Maynardia*) *pineria* DALL, Proc. U. S. Nat. Mus., 1895, p. 6.

"This is nearest related to *Pupa cyclostoma* Küster, but is small and easily distinguished by its finer, closer, and more even ribbing. Like all the species of its genus it is variable, and has among others a small variety with very regular ribbing, which hardly exceeds 10 mill. in length, and is doubtless the smallest form belonging to the genus which has yet been reported."

Some specimens are a little larger, 15x6 to 15x7 mill. There are 42 to 45 riblets on the penult. whorl, and usually the corneous-brown stripes pass over both ribs and intervals. The parietal lamella is very small, 1 to 1½ mill. long, and the parietal callus moderately thick, but somewhat transparent. The specimen figured is one of the original lot.

C. CUMINGIANUM (Pfeiffer). Pl. 32, fig. 25.

Shell deeply rimate, ovate-oblong, rather solid, *irregularly hair-striate*; white, somewhat tessellated above with brownish-corneous spots. Spire convex, attenuated above, the apex corneous, rather acute, suture linear. Whorls 9, nearly flat, the last a little exceeding one-third the total length, ascending in front, the base somewhat compressed near the umbilical chink. Columella deeply denteplicate, the parietal wall provided with a moderate sized entering fold. Aperture vertical, truncate-oval; peristome callous, narrowly

expanded throughout, the margins converging, joined by a thin callus; right margin arcuate, columellar margin somewhat dilated. Length 17, diam.  $7\frac{1}{2}$  mill. (*Pfr.*). *Cuba* (Poey).

*Pupa cumingiana* PFR., Proc. Zöol. Soc., Lond., 1852, p. 68; Monogr., iii, p. 539.—KÜESTER, Conchyl. Cab., p. 162, pl. 19, f. 23-25.

Known to me by the original description and figures only. The specimens reported from the Bahamas by Bland do not seem to be the same.

Var. *paredonis* Pilsbry, n. v. Pl. 32, figs. 21, 22.

Shell cylindric or ovate, fleshy-white with faint maculation above, or blotched throughout with brown, the ribs mainly white. Whorls  $8\frac{3}{4}$  to 10, slightly convex, sculptured with stout rounded ribs a little narrower than the concave intervals, and 22 to 28 in number on the penultimate whorl. Aperture dark brown within and wrinkled in harmony with the external ribs; peristome white, narrowly reflexed. Parietal callus very thin, the ribs showing strongly through it; *parietal lamella low, but long*, deeply entering to a dorsal position; axial lamella tooth-like.

Length 17, diam. 6.8, longest axis of aperture 6 mill.

Length 15, diam. 6.5, longest axis of aperture 6 mill.

Length 18.8, diam. 7.5, longest axis of aperture 7 mill.

*Cayo Paredon Grande*, off N. shore Puerto Principe, Cuba. (Arango.)

The fleshy-white specimen is cylindric, with comparatively coarse ribs; the mottled shells, which I regard as typical of the variety, are smaller, tapering, with finer ribs. The dark mouth and long parietal lamella are the same in all. This form may be a tangent from the *C. mumia* stock.

C. MICROSTOMUM (Pfeiffer). Pl. 32, figs. 30, 31.

Shell deeply rimate, subcylindric rather solid, *closely and lightly ribbed*; whitish, irregularly marked with brownish-corneous streaks. Spire lengthened, produced in a rather obtuse cone; suture impressed; whorls 10, slightly convex, the last not quite one-third the total length, slightly ascending in front, somewhat compressed and sharply striate at the base. Aperture lunate-rounded, pale livid within, provided with a compressed parietal tooth and an obsolete columellar fold; peristome simple, narrowly expanded, the margins

joined by a thin callus, columellar margin dilated. Length 21–22, diam. 7, aperture with peristome 7 mill. long, 6 wide (*Pfr.*).

Among many of the typical form, a few occurred of larger size, narrow, uniform white or with very pale marking (*Pfr.*).

Cuba: *Punta de Jicaco* (Icacos or Hicacos), north of Cardenas, in Matanzas province (*Pfr.*).

*Pupa microstoma* PFR., Malak. Bl., 1852, p. 207, pl. 3, f. 15, 16; Monogr., iv, p. 659 (exclusive of var.  $\gamma$ ).—? SOWERBY, C. Icon., pl. 2, f. 8.

A rather slender, fine-ribbed and small-mouthed form, not identified with any certainty from any but the type locality. The original description and figures are given. It differs from *C. cyclostomum* in the thin parietal callus.

*C. GUNDLACHI* (Pfeiffer). Pl. 52, figs. 32, 33, 34, 35.

Shell rimate-perforate, oblong-ovate, rather solid, nearly smooth; corneous, elegantly variegated with angular streaks and spots of opaque white. Spire ovate-conic, the apex rather obtuse; whorls 9, flattened, the last ascending in front, nearly two-fifths the shell's length, sub-compressed at the base. Aperture vertical, truncate-oval, with a deeply placed parietal tooth, which is frequently obsolete. Columella with a slight fold; peristome white, somewhat thickened, narrowly spreading. Length 15, diam. in the middle 7 mill.; aperture with peristome 6 mill. long (*Pfr.*).

Cuba: *Punta de San Juan de los Perros* (Gundlach).

*Pupa gundlachi* PFR., Zeitschr. f. Malak., 1852, p. 175, pl. 1, f. 39–42; Monogr. iii, p. 537.

It is often smaller, length 13, diam. 5.7 mill.; and according to specimens in the collection of the Academy, it is densely and finely rib-striate on the cone and the latter part of the last whorl. This variation has been described by Pfeiffer, who enumerates two forms, one smaller and almost unicolored corneous, with only scattered dots of white (fig. 34), the other also smaller and distinctly striate (fig. 35).

The parietal lamella is short and small, sometimes hardly perceptible.

*C. TENUILABRE* ('Gundlach' Pfr.). Pl. 32, fig. 26; pl. 44, f. 74.

Shell shortly rimate, cylindric, rather short, terminating in a *straight-sided cone*; rather solid. Brownish-corneous, irregularly

speckled with cream-white, most of the striae of that tint. Whorls  $9\frac{1}{2}$  to 10, nearly flat, the first  $1\frac{1}{2}$  smooth, convex, the rest closely and evenly rib-striate, the riblets rounded and about as wide as their intervals; last whorl ascending in front. Aperture truncate-ovate, pale within; the parietal lamella small, rather short, axial lamella inconspicuous from in front, extending deeply inward. Peristome brownish-white, blunt, a little expanded; parietal callus a straight, more or less raised ledge.

Length 20, diam. 9 to 10 mill.

Length  $18\frac{1}{2}$ –21, diam. 9 mill.

Cuba: *Barigua*, near Mata, on the N. shore near the eastern end of the island (Gundlach, Arango).

*Pupa tenuilabris* Gundl. in litt., PFR., Malak. Bl., xvii, p. 91 (1870); Monogr. viii, p. 356.

A rather short, thick-set, dingy species, with strictly conic or even slightly concave terminal cone and fine, even rib-striation. The description and figure are from specimens from the type locality.

Subsp. PYGMÆUM Pilsbry and Vanatta. Pl. 32, figs. 27, 28, 29.

Shell small and rather thin, varying from cylindric to short oval or suborbicular. Whorls 7 to  $8\frac{1}{2}$ , the latter 2 to 3 of sub-equal diameter, those above forming a stumpy (often *very* short) cone. Rusty brown. Surface regularly and finely rib-striate; apical whorl smooth, next whorl finely and regularly striated. Last whorl ascending in front, having a very short umbilical rima below. Aperture brownish within, rounded, obliquely truncate above. Peristome white, blunt, slightly expanded; parietal callus thin. Axial fold inconspicuous; parietal tooth deep within and extremely small.

Length 10, diam.  $6\frac{1}{3}$ ; long axis of aperture 5 mill.

Length 12, diam. 7; long axis of aperture  $5\frac{2}{3}$  mill.

Length  $14\frac{2}{3}$ , diam.  $6\frac{1}{3}$ ; long axis of aperture  $5\frac{1}{2}$  mill.

Cuba: *Gibara*.

*Cerion tenuilabre pygmæum* P. and V., Proc. A. N. S., Phila., 1896, pp. 325, 335, pl. 11, f. 9.—*Pupa cyclostoma* SOWERBY, Conch. Icon., xx, pl. 19, f. 179.

The short, typical form of this subspecies is extremely peculiar in shape, being shorter than any other *Cerion*. Longer examples are more like *C. tenuilabre*, which differs in having the aperture less rounded, the spire different in shape, the parietal callus less defined,

and the parietal lamella is better developed, besides being of larger size. The locality of *pygmæum* is over 100 miles east of that of *tenuilabre*. Probably the intervening territory will supply intermediate forms. 25 specimens examined.

C. CRASSIUSCULUM 'Torre' P. and V. Pl. 32, figs. 36, 37.

Shell shortly and deeply rimate, cylindrical, rather solid, lustreless, light brown or yellowish-brown throughout. Latter three whorls of equal diameter, or wider above, those above tapering in a *short cone with straight or slightly concave outlines*; apex obtuse, rather mammillar. Sculptured with rather close, regular, strong riblets, which are somewhat oblique, varying from as wide to half as wide as the interstices, and about 28 in number on the antepenultimate whorl; *becoming obsolete or partially so on the last whorl*. Whorls nearly 10, but slightly convex, the last slightly ascending in front. Aperture vertical, with a very small, short parietal tooth, and moderate axial fold; peristome blunt, expanded, subreflexed, the terminations distant, connected by a moderate parietal callus.

Length 21, diam.  $8\frac{1}{2}$ , long axis of aperture  $8\frac{1}{2}$  mill.

Length 20, diam.  $9\frac{1}{2}$ , long axis of aperture  $8\frac{1}{2}$  mill.

Eastern Cuba: *Cayo Juin*, Baracoa (Prof. de la Torre, F. E. Blanes).

*Cerion crassiusculum* Torre, PILSBRY and VANATTA, Proc. Acad. N. S., Phila., 1898, p. 478, f. 7, 8.

There is a small form, alt.  $13\frac{1}{2}$ , diam.  $6\frac{1}{2}$ , length of aperture 5 mill., having all the characters of the larger except that there are only 8 whorls (fig. 37).

The last whorl in this species is half the total length of the shell or a trifle more, and upon it the ribs are weak or wholly obsolete. Compared with *C. microdon*, it differs in the concave instead of convex outlines of the terminal cone, and the color. It differs from *C. tenuilabre* in the coarser sculpture; and from both in the comparatively smooth last whorl.

Var. SMITHII 'Blanes' Pilsbry, n. v. Pl. 32, fig. 38.

Shell similar in form but somewhat larger, and *smooth*, fine riblets appearing on several whorls of the cone. Whorls 10, those of the cone convex, the rest nearly flat. Lip reflexed and somewhat thickened. Length  $25\frac{1}{2}$ , diam. 10, long axis of aperture 10 mill.

*Sagua de Tanamo* (F. E. Blanes).

A smooth form, from the same coast.



*C. MICRODON* (Pilsbry and Vanatta). Pl. 28, fig. 36.

Shell varying from cylindric to stout oval, strong and solid; whitish with some inconspicuous gray flecks. Whorls  $8\frac{1}{2}$  to  $9\frac{1}{2}$ , the first one smooth, next finely and regularly costellate, following whorls with coarser riblets becoming regular, curved and moderately coarse on the cylindrical portion, somewhat narrower than the intervals, and 28 to 30 in number on the penultimate whorl; on the base of the last whorl the riblets become obsolete or subobsolete. Later 3 to 4 whorls of about equal diameter, those above forming rather a long cone with convex outlines and obtuse apex. Aperture rounded, truncate above, white within. Peristome white, narrowly expanded and subreflexed, obtuse; parietal callus very thin or moderate. Axial fold inconspicuous from in front; parietal tooth extremely small, short.

Length  $21\frac{1}{2}$ , diam.  $10\frac{1}{2}$ , long axis of aperture 9 mill.

Length  $19\frac{1}{2}$ , diam.  $9\frac{1}{2}$ , long axis of aperture 8 mill.

Length  $18\frac{1}{2}$ , diam. 10, long axis of aperture  $7\frac{1}{2}$  mill.

*Cuba.*

*Cerion incrassatum microdon* P. and V., Proc. A. N. S. P., 1896, pp. 319, 328, pl. 11, f. 5.

The convex and obtuse terminal cone, want of color, and more widely spaced and arcuate riblets, separate this species from *C. tenuilabre*; but the small, deeply-placed parietal lamella and the style of sculpture show it to belong to the same group, and not near *C. incrassatum* or *dimidiatum*, where it was originally placed.

*C. VENUSTUM* (Poey).

Shell rimate, conic ovate, solid, glossy, elegantly sculptured with close riblets; apex rather obtuse, flesh-colored; marbled with irregular oblique stripes. Whorls 9, flattened, narrow, the last ascending in front, compressed at the base. Aperture ovate-oblong, fulvous inside; plicæ obsolete; peristome thickened, expanded, white, the margins joined by a callus. Length 24, diam. 10 mill.; longest axis of aperture with peristome 11, width 9 mill. (*Poey*).

*Cuba* (Dr. D. Regino Perez).

*Pupa venusta* POEY, Memorias, ii, p. 30 (1856-1858).—PFR., Monogr., iv, p. 659.

There are 56 riblets on the last entire whorl. It resembles the

figure of *striatella* of Guérin's plate 6, f. 12, but that has a parietal tooth.

This species seems allied to *C. weinlandi*, *agrestinum*, etc., of the Bahamas, and may perhaps be no Cuban shell.

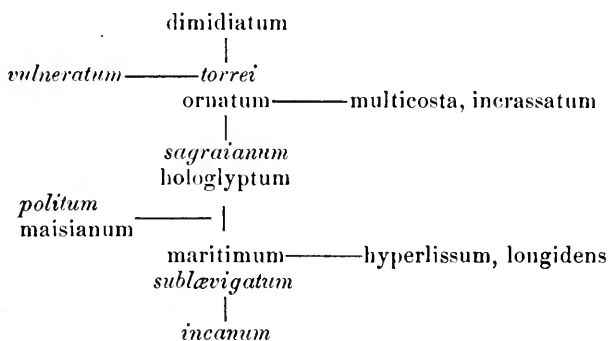
V. *Group of C. maritimum.*

*Pinguitia* MAYNARD, Contrib. to Sci., iii, p. 330, for "*S. dimidiata*."

Rather large, stout, cylindric species, ribbed, rib-striate or smooth, the sutures but slightly impressed; the parietal tooth usually short (but sometimes lengthened), characteristic of Cuba, especially the north coast.

Many of the species of this group have a smooth and a ribbed form. The parietal tooth is usually short, but in some specimens of certain species it continues inward to a dorsal position. This is the case with the example of *C. maritimum* figured on pl. 30, fig. 74. These long-toothed forms seem to differ in no other respect from the normal short-toothed examples of the same species. Two species, *C. longidens* and *C. hyperlissum*, seem to be constantly long-toothed.

The general relationships of the species may be expressed diagrammatically. Names in *italic type* pertain to smooth, the others to sculptured forms.



The species are all variable, impossible to limit by hard-and-fast diagnoses. In a few forms, especially the extreme *proteus* form of *C. dimidiatum*, some incised spiral lines are developed—a feature culminating in the allied group of *C. scalarinum*. The key below is

for typically developed specimens, and of course is quite artificial.

a. Shell of robust, broad contour.

b. Smooth on the cone or throughout.

c. Diameter over half the length; cone very short; whitish; ribbed or smooth. *dimidiatum*, p. 205.

c<sup>1</sup>. Smooth or nearly so; richly variegated. *torrei*, p. 207.

b<sup>1</sup>. Ribbed throughout.

c. Unicolored, usually snow-white. *multicosta*, p. 208.

c<sup>1</sup>. Bluish; lip very thick, sinuous above.

*incrassatum*, p. 207.

c<sup>2</sup>. Variegated with brown.

*ornatum*, p. 208.

a<sup>1</sup>. Shell moderately stout, the diam. usually contained  $2\frac{1}{2}$  times or more in the length.

b. Interior rich purple. *iostoma*, p. 210; *arangoi*, p. 211.

b<sup>1</sup>. Parietal tooth long.

c. Shell long and slender.

*hyperlissum*, p. 211.

c<sup>1</sup>. Shell rather short.

*longidens*, p. 212.

b<sup>2</sup>. Without either of the above characters.

c. Shell slender, richly variegated with purple-brown; lip narrow. *vulneratum*, p. 219.

c<sup>1</sup>. Shell moderately stout in figure.

d. Cone short; parietal tooth doubled or buttressed.

*politum*, p. 217.

d<sup>1</sup>. Cone longer; parietal tooth simple.

e. Species of Florida Keys and Bahamas.

*incanum*, p. 213.

e<sup>1</sup>. Species of Cuba.

*maritimum*, p. 212.

*sagraianum*, p. 216.

# C. DIMIDIATUM (Pfeiffer). Pl. 28, figs. 27-32.

Shell perforate and rimate, solid, cylindric, *very obese*, often widest above, white or whitish. Whorls about  $10\frac{1}{2}$ , the first one smooth, the next two finely and densely striate, the rest of the *whorls of the very short, wide cone nearly smooth, flat*; last three whorls forming the cylindrical portion, sculptured with curved ribs, which vary from strong and regular to irregular, or they may even be completely absent. A group of spiral incised lines may usually be seen below the middle of each whorl. Last whorl ascending in front, having the rather flattened base defined by a revolving cord (sometimes obso-

lete), below which radial wrinkles replace the ribs. Aperture rounded-ovate, flesh-colored inside, the peristome reflexed. Parietal lamella short, small or subobsolete; axial lamella hardly or not visible in front, weak within the last whorl.

Length 30, diam. 16 mill. (type of *dimidiata* Pfr.).

Length  $25\frac{1}{2}$ , diam. 18 mill.

Length 27, diam. 16 mill.

N. coast of prov. Santiago de Cuba, at *Gibara* (Gundlach).

*Pupa dimidiata* PFR., Zeitsch. f. Malak., 1847, p. 16; Monogr., ii, p. 316.—*Pupa proteus* Gundl., PFR., Malak. Bl., vii, 1860, p. 19; Novit. Conch., p. 267, pl. 66, f. 13–22; Monogr., v, p. 291.—ARANGO, Fauna Malac. Cubana, p. 101.—SOWERBY, Conch. Icon., xx, pl. 1, f. 4.—*Strophia (Pinguitia) dimidiata* Pfr., MAYNARD, Contrib. to Sci., iii, p. 30, pl. 6, f. 6, 7 (March, 1896).

The name *dimidiatum* was originally applied to a rather long and cylindric form, while *proteus* was based upon the shorter and more strongly characterized shells. Pfeiffer abandoned the former name because he considered it to apply to a non-typical form of the species. The original description follows:

"Shell rimate, cylindric-ovate, solid, having distant and arcuate folds, dull white. Spire bee-hive shaped, the apex shortly conic; suture shallow. Whorls 11, narrow, rather flat, the upper smooth, the last bipartite, subcarinate in the middle, marked below the angle with several impressed, crowded, spiral lines, and densely striated from the center, the base swollen. Aperture nearly semicircular, peristome thickened, expanded, the margins joined by a straight callus, right margin subauriculate. Length 30, diam. 16 mill.; oblique length of aperture with peristome 13, width 11 mill." (Pfr.).

The shortest specimen I have seen measures 22x16 mill., and has  $9\frac{1}{2}$  whorls (fig. 31); the largest is 32x17 mill., with 11 whorls. Aside from this great variation in size and proportions, there is variation in sculpture, some shells before me totally wanting ribs (fig. 32). The keel defining the base is also variable, and sometimes entirely wanting. All forms of the species are distinguished by the very low, wide cone of the spire.

There is a much less differentiated form of the species, in which the cylindric shell is regularly sculptured with nearly straight ribs, which may be quite numerous with intervals of their own width (pl. 28, fig. 33) or rather spaced (pl. 28, fig. 34); the number of ribs

varying, 23, 25, 33, 37 on the penult. whorl of several specimens. The cord and depression defining the base in the typical form are obsolete, but the base is finely striated, not ribbed, and sometimes, as in the original of fig. 34, the group of spiral striae persists. This form occurs at Gibara.

*C. INCRASSATUM* (Sowerby). Pl. 28, fig. 35.

"Shell obese, cylindrical, slightly truncated, bluish; ribs rather oblique, distant, smooth. Aperture auriform, flexuous; margin whitish, very thick; outer lip flexuous above, inner lip with two strong folds. It resembles *P. proteus*, but its chief peculiarity is a much thickened and flexuous margin" (*Sowb.*).

Length  $37\frac{1}{2}$ , diam. 15 mill. (from fig.).

*Cuba* (type in British Museum).

*Pupa incrassata* SOWERBY, Conch. Icon., xx, pl. 1, f. 6.—*P. tumida* SOWB., MS., olim.—*Cerion incrassatum* P. and V., Proc. A. N. S., 1896, p. 319.

The type-figure of this species is copied in my fig. 35, and the original description is given above. I have not identified the species with certainty, but some specimens of *C. torrei ornatum* approach it, though they are smaller, with a less developed axial lamella, and without the bend in the outer lip, believed by Sowerby to be characteristic of his species.

*C. TORREI* 'Blanes' P. and V. Pl. 28, figs. 39, 40.

Shell cylindrical, *obese*, strong, rimate and perforate, the lower two or three whorls of approximately equal diameter, those above forming a rather *short cone* with sides diverging at an angle of  $85^{\circ}$  to  $90^{\circ}$ . Whorls 10–11, the earliest  $1-2\frac{1}{2}$  white or corneous, several following finely and sharply striated, the remaining whorls nearly smooth; last whorl ascending in front, somewhat tapering below, and generally striated at the base. Brown, marbled with very irregular stripes and dots of white. Aperture short, showing a small short parietal lamella and a small axial lamella; peristome white, thickened and convex, reflexed and recurved, continuous, the parietal margin more or less calloused.

Alt.  $23\frac{1}{2}$ , greatest diam. 13, length of aperture 11 mill.

Alt. 28, greatest diam.  $12\frac{1}{2}$ , length of aperture 11 mill.

Alt. 24, greatest diam.  $11\frac{1}{2}$ , length of aperture 10 mill.

Port of Vita, Cuba (Francisco E. Blanes).

*Cerion torrei* Blanes, PILS. and VAN., Proc. Acad. Nat. Sci., Phila., 1898, p. 476, f. 1, 2 (Jan. 13, 1899); with var. *ornatum* P. and V., l. c., f. 3, 4.

This species resembles *C. dimidiatum* in shape, differing in the less rude texture, less squarely obese form, higher terminal cone, no trace of a keel defining the base, etc. It has the coloration of *C. vulneratum*. *C. torrei* differs from *C. sagraianum* in the shortening of the whole shell and especially the cone of the spire.

A tray in the collection of the Academy from Gibara, contains entirely smooth fleshy-whitish specimens, not variegated, varying in size:  $27\frac{1}{2} \times 12\frac{1}{2}$  to  $25 \times 11$  mill., and one shell with regular and distinct, though excessively low, almost obsolete ribs, measuring  $26 \times 12\frac{1}{2}$  mill. They were mingled with the strongly-ribbed *dimidiatum* described above, and together with them seem to form a connection with *C. torrei* and its ribbed variety. Further series of fresh specimens with exact locality data are needed to elucidate these relationships.

Var. *ornatum* Pils. and Van. Pl. 28, figs. 41, 42.

Similar in form to the longer specimens of *C. torrei*, being cylindrical, blunt at the ends; strongly and regularly ribbed throughout, the ribs on the cylindrical portion from one to one and a half mill. apart, and decidedly narrower than the intervals; parietal margin of peristome more elevated.

Length  $26\frac{1}{2}$  to 32, diam.  $12\frac{1}{2}$  mill.

*Vita, Cuba* (Prof. de la Torre).

This looks like a distinct species, but we consider it merely a costate form of the preceding. It is more slender than the ribbed form of *C. dimidiatum*, with finer ribs, continued upon the terminal cone, and there is no basal keel. Its possible relation to *C. incrassatum* has been alluded to above. *C. multicostum* has a nepionic shell of slightly over  $2\frac{1}{2}$  whorls, and the cone is distinctly attenuated above, while in *ornatum* there are but  $2\frac{1}{4}$  nepionic whorls, and the outlines of the terminal cone are slightly convex. The larger specimen figured has 24, the smaller 29 riblets on the penultimate whorl.

*C. MULTICOSTUM* (Küster). Pl. 28, figs. 37, 38.

Shell rimate, cylindric, solid pure white or flesh-tinted. Whorls nearly 11, the first  $1\frac{1}{2}$  smooth, then striate, becoming costulate; the last three whorls forming the cylindrical portion, on which the ribs

are strong, but narrower than their intervals, nearly regular, slightly curved, 30-32 on the penult. whorl. Terminal cone rather attenuated above, *the lateral outlines being straight* or even slightly concave. Aperture truncate-ovate, purplish- or yellowish-brown in the throat, the lip ivory-white. *Parietal lamella narrow, rather long*, usually with a low continuation inward. Axial lamella small but rather acute.

Length 31-33, diam. 14 mill.

Length  $29\frac{1}{2}$ , diam.  $13\frac{1}{2}$  mill.

Length 26, diam. 11 mill. (Küster's type, fig. 37). *Cuba*.

*Pupa multicosta* KÜSTER, Conchyl. Cab., *Pupa*, p. 77, pl. 11, f. 6, 7.—PFR., Monogr., ii, p. 323.—*Pupa multicostata* SOWB., Conch. Icon., xx, pl. 2, f. 13.—?? *Helix decumana* var. *a* FERUSSAC, Tabl. Syst., p. 59, no. 462 (based upon Lister, pl. 588, f. 47).—*Pupa decumana* GRAY, Ann. of Philos. (new ser.), ix, p. 413.—PFR., Monogr., ii, p. 320 (except references to Sowerby and Reeve).

The original locality was merely "West Indies," and the original description and figures apply about as well to some Bahaman forms as to the Cuban. Although so much must be admitted, I consider it best to retain the traditional identification with the Cuban form defined above; thinking it impossible to better it.

*C. multicostum* differs from *C. torrei ornatum* in the longer or at least more attenuated terminal cone, and the longer parietal lamella, which has usually a low continuation or prolongation inward. It is wider than *C. maritimum*, and has stronger ribs.

None of the specimens before me, some five lots from three sources, bear label more definite than "Cuba;" and Arango gives nothing more. It is probably from the northern shore of the eastern end of the island.

The variety referred here by Küster (C. Cab. pl. 10, f. 1, 2) is of doubtful identity, but I think it is probably *maritima*, as Pfeiffer suspected.

The figure in Lister upon which *Pupa decumana* Gray was based is not determinable.

The *Pupa tumidula* of Deshayes seems to have no differential characters of importance. The original description here follows:

*Pupa tumidula*. (Pl. 30, fig. 71.) Shell ovate-acuminate, inflated, short, grayish-white, the apex obtuse; longitudinally plicatocostate; spire with conic apex; whorls 10, narrow, the last convex

beneath, deeply rimate, ascending to the aperture. Aperture sub-circular, rufous inside; peristome thickened, reflexed, the margins continuous. Columella with a fold at the base, the left margin one-toothed. Length 30, diam. 14 mill. *Desh.* in Ferussac, Histoire, ii, p. 207.—*Helix* (*Cochlodonta*) *uva* FER., Hist., pl. 153, f. 8.

*Cuba* (Deshayes).

The ribs are somewhat more spaced than in *multicostum*.

*C. iostomum* (Pfeiffer). Pl. 28, fig. 44.

Shell deeply rimate, oblong-conic, solid, distantly plicate-costate, opaque, calcareous; spire lengthened, terminating in a slightly obtuse, densely costulate cone, marbled with corneous. Suture with exerted margin. Whorls 11, nearly flat or a little convex, the last forming two-fifths the length, ascending in front, corrugated, the base compressed. Aperture truncate-oval, violet colored within, provided with a deep-seated parietal tooth and an oblique columellar fold. Peristome thick, reflexed throughout, the margins joined by a rather thick callus, columellar margin flexuous. Length 32, diam. 12, aperture with peristome 13 mill. long, 10 wide (*Pfr.*).

*Cuba*: on the southern coast, on *Opuntia* (Gundlach).

*Pupa iostoma* PFR., Malak. Bl., 1854, p. 204; Monogr., iv, p. 656; vi, 289 (exclusive of locality, Turk's Island).—SOWB., C. Icon., pl. 3, f. 22.—*Cerion iostomum* PILS. and VAN., Proc. A. N. S. P., 1896, pp. 320, 329, pl. 11, f. 14, with var. *arangoi*, t. c., p. 330, pl. 11, f. 12.—*Cf.* ARANGO, Fauna Mal. Cub., p. 100.

Pfeiffer mentions two forms: *b* is somewhat more obese, with the median whorls nearly smooth, only very finely rippled, the last with spaced folds; and *g* is smaller, and more or less, but always distantly, ribbed, length 21–25 mill.

The specimen figured answers to the description of Pfeiffer in all respects save that the median whorls are only obsoletely ribbed, hardly "*distanter plicato-costata*"—more like the "*var. β.*" The post-nepionic whorls of the cone are "*conferte costulatum*;" the cone itself "*corneo-marmoratum*," suture conspicuously "*exserto-marginata*," and the corrugation of last whorl and color of aperture ("*intus violacea*") are likewise in agreement. The specimen figured is 2 mm. shorter than Pfeiffer's. Length 30, diam. 12; alt. of aperture 12 mill.

This species was described from the south coast of Cuba living



among prickly pears. Subsequently it was reported from Turk's Island and Great Inagua (see Bland, Ann. Lyc. Nat. Hist., N. Y., XI, p. 85), but specimens from these localities, labeled by Bland, prove to be totally distinct species, having little save the purplish-brown color of the mouth, in common with the true *Pupa iostoma* of Pfeiffer's first description.

Var. *arangoi* Pilsbry and Vanatta. Pl. 28, figs. 45, 46.

Shell similar to the type in form, but smaller. Later *two* whorls only of equal diameter, those above forming a rather long cone. Whorls  $8\frac{1}{2}$  to 9. Surface *closely and regularly ribbed* throughout (except the smooth nepionic whorls), the ribs 31 to 36 in number on the penultimate whorl, mainly white, interstices purplish-brown, mottled with white. Sutures without noticeably exerted margination. Aperture deep, rich purple within, the parietal lamella small and short, as in typical *iostomum*.

Length  $23\frac{1}{2}$ , diam.  $10\frac{2}{3}$ ; alt. of aperture 9 mill. (36 riblets).

Length  $18\frac{2}{3}$ , diam. 9; alt. of aperture 8 mill. (31 riblets).

Length 24, diam.  $10\frac{2}{3}$ ; alt. of aperture  $9\frac{2}{3}$  mill.

*Cienfuegos*, on the S. coast of prov. Santa Clara, Cuba (R. Arango).

Strikingly different from *iostomum* at first sight, but we believe it to be closely allied and probably a subspecies thereof. It was probably this form which Sr. Cisneros found in abundance at Cayo Carénas, near Cienfuegos, as quoted by Arango. The locality "Cardenas" for *iostomum*, also given by Arango, is probably erroneous.

C. HYPERLISSUM Pilsbry and Vanatta. Pl. 28, fig. 43.

Shell moderately strong, much elongated, cylindrical, the later four whorls of about equal diameter, those earlier gradually tapering, forming an obtuse cone with slightly convex outlines. Pinkish-brown (with more or less white maculation), the riblets white. Whorls  $11\frac{1}{2}$ , weakly convex, *those of the cone smooth*, the rest sculptured with rather fine riblets narrower than the intervals, about 36 in number on each of the several later whorls. Umbilicus a short rimation, compressed. Aperture ovate, decidedly higher than wide, the throat flesh-tinted. Peristome white, well reflexed and revolute, thickened; parietal callus light, its edge hardly thickened; parietal fold median, *very long*, one-fourth to one-third of a whorl in length.

Length  $32\frac{1}{2}$ , diam. 10; alt. of aperture 12 mill.

Length  $29\frac{1}{2}$ , diam. 10; alt. of aperture 11 mill. Cuba.

*C. hyperlissum* P. and V., Proc. Acad. Nat. Sci., Phila., 1896, pp. 320, 330, pl. 11, f. 10.

This species has the unusually long parietal tooth of the Little Cayman Island Cerions. For the rest, it does not differ remarkably from such Cuban forms as *C. maritimum*. The whorls of the cone are ribless, unlike ribbed members of the *maritimum* group.

A form also referable to this species is much striped and maculated with fleshy-brown and white, the riblets being finer.

*C. LONGIDENS* n. sp. Pl. 32, figs. 23, 24.

Shell shortly rimate, oblong or subcylindric, very solid and strong; flesh-colored with nearly white ribs. Sculpture of strong, rather close, subregular ribs, about 30 in number on the penultimate whorl; on the last whorl the ribs become lower and split at the periphery, so that *the base is rather finely, irregularly rib-striate*. Whorls 9 in short, to  $10\frac{1}{2}$  in long specimens, but slightly convex, the last broadly rounded below. Aperture ovate, whitish or pale within; peristome reflexed and recurved, strongly thickened, white or pale reddish-brown; parietal callus rather heavy. Parietal lamella low and rather slender but *very long*, extending inward to the dorsal side, only slightly curved. There is a low callus or accessory tooth on the left side of the outer end of the parietal lamella. Axial lamella small at the aperture, strong within.

Length 24, diam. 11.5 mill.

Length 22.5, diam. 10.5 mill.

Length 26.5, diam. 10.8 mill. Cuba: Cabo Cruz (Bland).

This species has a long parietal lamella like the Little Cayman species. In general external appearance it approaches typical *C. glans*. The embryonic whorls are either ochre-colored or white.

*C. MARITIMUM* (Pfeiffer). Pl. 30, figs. 72, 73, 74.

Shell deeply rimate, cylindric, solid, pure white or sometimes sparsely variegated with reddish-brown or gray, the apex yellowish. Whorls 10–11, nearly flat, the last 3 of about equal diameter, those above forming a terminal cone, the outlines of which are convex below, straight above; apex obtuse. Sculptured throughout with low and narrow, close, regular riblets. Aperture truncate ovate, pale flesh-tinted or yellowish inside. Parietal lamella small and

usually short; axial lamella small. Peristome well reflexed, not thickened; parietal callus rather heavy.

Length 30, diam. 12, length of aperture 11-13 mill.

Length 35, diam. 13 mill.

Cuba, northern shore of Matanzas Province: *Punta de Maya*, at the entrance of Matanzas Bay on sticks and stones, close to high tide mark, in company with *Tectarius muricatus* (Pfr., type loc.); *Cayo Blanco* near Cardenas (Gundlach). *Boca de Jaruco* (Clerch).

*Pupa maritima* PFR., Archiv f. Naturg., 1839, i, p. 353; Monogr. ii, p. 322; iii, 539; iv, 657 (forms *typica* and *sublaevigata*); vi, 289; Malak. Bl., 1854, p. 205.—KUSTER, Conchyl. Cab., *Pupa*, p. 70, pl. 9, f. 10, 11 (typical form), f. 12, 13 (smooth form).—ARANGO, Fauna Mal. Cubana, p. 101.—*Strophia maritima* Pfr., MAYNARD, Contrib. to Science, i, p. 127, f. 31, pl. 13, f. 1, 1a (smooth form).—*Cerion maritimum* Pfr., P. and V., Proc. A. N. S., Phila., 1896, p. 320.—*C. m. sublaevigatum* Pfr., P. and V., P. A. N. S., 1895, p. 209.—? *Pupa mumia* POT. and MICH., Galerie, i, p. 169, pl. 17, f. I, 2.

Typical *C. maritimum* is distinctly and rather finely costulate, and while usually almost unicolored whitish, it is occasionally somewhat mottled or sparsely speckled, like *C. mumia chrysalis*. The costulation is decidedly coarser than in the ribbed form of *C. sagraianum*. *C. incanum* is smoother than *maritimum*. The young are usually toothless, but sometimes have 4 teeth and an axial plait.

Form *sublaevigatum* Pfr. (Pl. 30, figs. 75, 76.) Shell smooth or nearly so, the riblets of the typical form being subobsolete or almost wanting except on the terminal cone, which is finely and densely rib-striate; whitish, the terminal cone often marbled with gray-brown. Occurs at *Punta de Maya*, at the eastern side of the entrance of Matanzas Bay, with the ribbed form (f. 75), on *Cayo Blanco*, and at or near Cardenas (fig. 76).

*C. INCANUM* (Binney). Pl. 29, figs. 48, 49, 50.

Shell rimate, cylindric, solid; white, usually tinted with gray, blue or fleshy; whorls 9-12, slightly convex or nearly flat, closely but lightly wrinkle-striate, the last three whorls of about equal diameter, those above slowly tapering, forming a cone with convex outlines and obtuse apex. Last whorl somewhat ascending in front. Aperture truncate-oval, white or flesh-tinted inside; parietal lamella short, rather small; axial lamella usually well developed, tooth-like.

Length 17-30 mill.

*Florida Keys; Gun Cay, Bahamas.*

*Pupa maritima* γ PFR., Monogr., iii, p. 539.—GOULD in Binney's Terr. Moll., ii, p. 316.—*Pupa incana* A. BINNEY, Terr. Moll. U. S., i, p. 109, name only; iii, p. 318, as a synonym of *P. maritima* (1851); iii, pl. 68 (1857).—LEIDY, t. c., i, pl. 15, f. 2-4 (anatomy).—PFR., Monogr., iv, p. 657; vi, 289, with var. *variegata*, based upon Binney's pl. 70 (error for 79), f. 17 (1868).—W. G. BINNEY, Terr. Moll., iv, p. 141, and var. *fasciata* p. 206, pl. 79, f. 17 (1859); Land and F. W. Sh. of N. A., i, p. 247, f. 430.—*Pupa detrita* Shuttleworth, PFR., Malak. Bl., i, p. 205, pl. 3, f. 9, 10 (1854).—SOWB., C. Icon. pl. 3, f. 17.—*Strophia incana* Binn., TRYON, Amer. Journ. of Conch., iii, p. 308, pl. 15, f. 19; Mon. Terr. Moll. U. S., p. 135, pl. 15, f. 19 (copied from Terr. Moll., iii, pl. 68, lower fig.).—W. G. BINNEY, Terr. Moll., v, p. 220, pl. 68, and fig. 126; Man. Amer. L. Shells, p. 419, f. 462, 463 (jaw and teeth), 464, 465 (shell).—MAYNARD, Contrib. to Science, i, p. 78, f. 13, pl. 7, f. 20, 20a.—SIMPSON, Proc. Davenport Acad., v, p. 68.—*Cerion incanum* Binn., PILS. and VAN., Proc. A. N. S. P., 1896, p. 320.—PILSBRY, Nautilus, xii, p. 26 (Gun Cay).—*C. incanum saccharimeta* Blanes, PILS. and VAN., Proc. A. N. S. P., 1898, p. 477, f. 5.

This species is generally smaller than *C. maritimum sublævigatum* of Cuba, and it has a longer cone with more obtuse apex. *C. incanoides* of Turk's Island is very similar, and distinguished chiefly by its decided excavation behind the columellar lip, the reflexed edge of which is pushed forward in the middle.

At *Key West*, the type locality, *C. incanum* occurs abundantly between the salt ponds and the northern shore. The shells are white, flesh-tinted or bluish, with several apical whorls light brown. Frequently there are a few rather ill-defined livid spots, more numerous on the cone. The variation in size is great: 30x11; 25x8½; 22x10; 17x7¾ mill. The last whorl is often irregularly wrinkled, almost subcostulate. Figures 48-50 are from Key West examples.

SUGAR-LOAF KEY. Var. *saccharimeta* 'Blanes' P. and V. (pl. 29, figs. 52, 53). The specimens are chalky-white with a blue tint, and corneous apical whorls, the next whorl being very *finely but distinctly rib-striate*. There are irregularly developed, *low and wide-spaced riblets* on the last one or two whorls. Terminal cone more tapering than in normal *incanum*. Size variable, from 38x13½ to 28x11½ mill. The specimens from this key show well-marked racial divergence.

**BOCA CHICA KEY.** According to Binney (Manual Amer. L. Shells, p. 420), Hemphill collected specimens 36 mill. long.

**KEY VACCAS.** At the east end of this Key, Dr. J. W. Velie collected many specimens of a small, *thin* form, with short terminal cone, and the sculpture of typical Key West shells. Color fleshy-white, more or less suffused or clouded with flesh-color, and sparsely or copiously streaked with livid spots. The peristome is thin and narrow. Size:  $22 \times 8$ ;  $22 \times 8\frac{1}{2}$  to  $18 \times 8$  mill. This slightly individualized race may stand as form *vaccinum* (pl. 29, fig. 51).

**BISCAYNE KEY.** Form *fasciata* W. G. B. (pl. 29, fig. 47). Rather small shells, somewhat more sharply and roughly sculptured than the Key West type, occur at the lower end of this Key. They are practically typical in size and form, and on a pale-brownish ground are *striped with brown*, the stripes zigzag and ragged on the cone, more regular below.

Pfeiffer has referred to this as var. *variegata*. Maynard's *Strophia fasciata* (Contrib. to Sci., i, p. 133) is the Key Vaccas variety.

**VIRGINIA KEY** (N. of Key Biscayne). Five specimens collected by Mr. S. N. Rhoads in 1899 are nearly white. Two of them are like Key West *incanum* in form and sculpture,  $23\frac{1}{2}$  and  $25 \times 10$  mill. The others are larger and stouter, like var. *saccharimeta*, though hardly so strongly plicate. The larger specimens have part of the first post-uepionic whorl sharply striate. They measure:  $35 \times 13$ ;  $26\frac{1}{2} \times 12\frac{1}{2}$ ;  $29\frac{1}{2} \times 11$  mill. All of them are "crab shells," and none were found living.

Virginia Key is probably the extreme limit of northeastward distribution in Florida; Rhoads thought that the Virginia Key specimens had probably been drifted there (Nautilus, xiii, p. 45). I could not find the species around Miami or opposite on the eastern shore of Biscayne Bay. Binney reports it from the mainland of Florida, but without definite locality. Simpson reports it from Torch Key and Pine Key, but without noting the particular forms found, from which circumstance it is likely that they did not differ from the Key West types.

**CUBA.** *C. incanum* has been recorded from Cuba on the authority of Poey. Several lots, so labeled, are in the collection of the Academy; but no definite Cuban locality has been put on record.

**BAHAMAS.** Gun Cay, one of the westernmost islets of the group. Indistinguishable from Key West forms except that the last whorl

is somewhat more costulate. Fleshly-white, with some livid spots and stains.  $20 \times 8\frac{1}{2}$  mill.

C. SAGRAIANUM (Pfeiffer). Pl. 30, figs. 77, 78, 79, 80.

Shell shortly rimate, cylindrical, solid; whitish, marbled with light or grayish-brown. Whorls 10–11, flat, the first two uniform light brown, *second to sixth whorls densely and regularly rib-striate*, subsequent whorls nearly smooth, glossy, with fine growth-lines only; the last 3 whorls of about equal diameter. Aperture irregularly ovate, tinted within. Parietal lamella strong, usually short. Axial lamella distinct. Peristome reflexed, moderately or heavily thickened; the parietal callus usually strong, sometimes elevated.

Length 23–24, diam. 9 mill. (Pfeiffer's types).

Length 32, diam. 13 mill.

Length 30, diam. 11 mill.

Cuba, Keys off the northern shore of Matanzas Province: *Cayo Galindo* (type locality); *Cayo Piedra* and *Cayo Blanco*, near Cardenas (Gundlach).

*Pupa sagraiana* PFR., Zeitschr. f. Malak., 1847, p. 15; Mal. Bl., i, 1854, p. 206; Monogr. ii, p. 322; iii, 539; iv, 658; vi, 290; Conchyl. Cab., p. 121, pl. 16, f. 4, 5.—SOWB., C. Icon., pl. 3, f. 19.—ARANGO, Fauna Mal. Cubana, p. 101.—*Strophia obscura* MAYNARD, Contrib. to Sci., iii, p. 21, pl. 3, f. 5, 6 (March, 1896).

The typical form (pl. 30, fig. 77) was small,  $22-24 \times 9$  mill., smooth and marbled. Pfeiffer mentions the following forms:

(b) Smaller, 17–18 mill. long, 8 wide. Punta de Jicaco, (probably *Punta Icacos*, N. from Cardenas).

(c) Large, the last whorl plicate; length 30, diam. 11 mill. *Cayo Piedra*.

(d) Still larger, with strongly developed peristome and distinct rib-striae; marbled; length 36, diam.  $11\frac{1}{2}$  mill. Or marked with darker streaks. *Cayo Blanco*.

The series before me shows all gradations between elaborately marbled and uniform whitish and flesh-tinted specimens. Sometimes the lower 4 whorls are smooth, sometimes the last is finely plicate at the base or throughout, or at base and near the suture. These lead to the form *d*, which for convenience may be called form *hologlyptum* (pl. 30, fig. 83), which is evenly and closely costulate throughout, and either marbled with pale flesh-brown on a whitish ground, or fleshy-brown, speckled with white, or with whitish riblets.

Specimens from Cayo Piedra del Norte (R. Arango) vary from chalky white sparsely maculate with gray on the cone, to the usual marbled pattern. They are nearly smooth, and measure from 29x12 to 26x10½ mill.

Form *obscurum* Maynard (pl. 30, figs. 81, 82). Rather thick and heavy, smooth, bluish-white, obscurely marked with zigzag longitudinal lines of very pale yellowish-brown, scarcely to be seen on the lower whorls, better developed on the cone of the spire. Whorls 9. Length 27½, diam. 10½ mill. Varying from 24½ to nearly 29 mill. long. Cayo Birde del Norte, Cuba. This seems to be practically typical *sagraianum*. I can find no difference whatever.

There are some small, smooth specimens, pinkish-white with indistinct flesh colored stripe-marbling, the last whorl bluish-white, in the collection of the Academy, labeled "Holguin, Cuba, Dr. Candelaria Herrera." This is far out of the well-established range of the species, and may be erroneous, especially as that place is inland.

C. POLITUM (Maynard). Pl. 30, figs. 84, 85, 86, 87, 88.

Shell shortly rimate, cylindrical, solid; typically *whitish, with conspicuous brown longitudinal stripes*, which may be nearly straight or somewhat dislocated or zigzag; are numerous on the upper portion of the shell, but fewer below. Whorls 9½ to over 10, those of the cone flat, or bulging below the sutures; the last 3 forming the cylindrical portion, somewhat convex; last whorl ascending. Cone of the spire of medium length or short, frequently as though crowded down or slightly "telescoped," the whorls of the upper half of the cone usually densely and sharply striate, *the rest of the shell smooth*, or having the base of the last whorl sharply plicatulate. Aperture large, open, brownish within; parietal lamella short, and usually *there is a callus or ill-formed lamella to the left of the parietal*, more or less connected with it, but diverging from it inwardly. Axial lamella distinct, Peristome reflexed, sometimes heavily thickened. Parietal callus moderate or heavy.

Length 26.2, diam. 11.2 mill. (Maynard's type).

Length 29.5, diam. 12.5 mill.

Cuba: *Cabo Cruz*, at the southwestern angle of Prov. Santiago de Cuba.

*Strophia marmorata polita* MAYN., Contrib. to Science, iii, p. 14, 15, f. 2B, pl. 3, f. 3, 4.

An exceedingly embarrassing form, closely allied to *C. sagraianum*, from which it differs in distribution (if the assigned locality is correct), in the shorter, more compact contour, the frequent duplication of the parietal lamella, and the broader striping of the typical form. It is less heavily marked with brown than *C. torrei*, and either has a longer terminal cone, or if as short, it is crowded down, as though sat upon, and then has each whorl a little swollen below the suture.

The color varies from the rather broad striping of fig. 87, or a dirty white, with more or less fleshy variegation on the spire (fig. 84), to dull fleshy brown, closely speckled and streaked with white—exactly the pattern of *C. sagraianum* (fig. 86).

Form *maisianum* Pilsbry, n. v. Pl. 30, figs. 89, 90, 91.

Shell cylindric, with rather short, obtuse terminal cone, whitish, boldly striped with brown, the stripes mostly angularly interrupted or dislocated. Whorls 9–10, sculptured closely and regularly with rather narrow riblets, usually 40 to 45 on the penult. whorl, but sometimes as few as 35. Parietal lamella of the aperture simple or duplicated, as described above for *C. politum*. Peristome moderately thick.

Length 29, diam.  $11\frac{1}{2}$  mill. Length 28, diam. 11 mill.

Length 29, diam.  $10\frac{1}{3}$  mill. Length  $23\frac{3}{4}$ , diam. 11 mill.

Cuba: *Punta Maisi* (Arango, de la Torre).

*Pupa marmorata* Pfr., ARANGO, Fauna Mal. Cubana, p. 101 (exclusive of synonymy).—*Strophia marmorata* Pfr., MAYNARD, Contrib. to Sci., iii, pp. 12, 13, fig. 2 A on p. 15; pl. 3, f. 1, 2. Not *P. marmorata* Pfr.

The present form is not *marmorata* of Pfeiffer (*q. v.*), a species of the Bahamas, which is described as merely striatulate, while this form has riblets.

This variety, while resembling *C. politum* in contour, coloration and teeth, is much like *C. maritimum* in sculpture; and in fact, is about as much like that species as typical *C. politum* is like *sagraianum*. Maynard's specimens were said to be from Cabo Cruz, and were on the same tray with *politum*. Those before me are from "Punta Maisi," sent by Arango. I suppose this to be Cape Maisi, the eastern extremity of Cuba. Prof. de la Torre gave me one from the same locality, informing me that a smooth form also occurs. This smooth form is evidently *politum*.



Mr. Maynard's remarks upon the teeth of *Cerion*, under his description of *S. polita*, give evidence of the workings of a philosophic mind upon an insufficient basis of fact.

*C. VULNERATUM* (Küster). Pl. 29, figs. 57, 58, 59, 60, 61.

Shell rimate, long and cylindric, not very thick; white, *closely zigzag-striped and marbled with brown and purplish-brown*, usually the dark, sometimes the light predominating. Whorls usually 10-11, the last 3 or 4 forming the cylindrical portion, *smooth*; those above forming a cone with convex sides and obtuse apex, *densely and minutely rib-striate*; the last whorl ascending in front, smooth or striate at base. Aperture truncate-ovate, brown inside; *parietal lamella long*, but low and narrow; axial lamella rather inconspicuous. Peristome white, *narrow*, expanded or subreflexed; parietal callus usually thin.

Length  $30\frac{1}{2}$ , diam. 10 mill. (elongate specimen).

Length 25, diam. 8 mill. (average specimen).

Length  $23\frac{1}{2}$ , diam.  $9\frac{1}{2}$  mill. (short specimen).

Cuba: *Gibara*, on the N. shore of Santiago de Cuba.

*Pupa vulnerata* Küster, Conchyl. Cab., p. 161, pl. 19, f. 16, 17.—PER., Monogr., iv, p. 658 (1859); vi, 290; Novit. Conch., p. 368, pl. 84, f. 18-23.—ARANGO, Fauna Mal. Cubana, p. 101.—*Cerion vulneratum* P. and V., Proc. Acad. Nat. Sci., Phila., 1896, p. 326.

Quite distinct by its rather thin shell, long, cylindrical form, and richly variegated color pattern, in which either purplish-brown or white may predominate. Rather rarely the dark markings almost disappear, leaving the shell whitish. In sculpture and coloration it is like the very much stouter *C. torrei*, which I believe to be closely related.

## VI. Group of *C. scalarinum*.

*Umbois* MAYNARD, Contrib. to Sci., iii, p. 28, type *S. scalarina*.

Shell strongly ribbed and densely sculptured with incised spiral striæ. Parietal tooth short and median.

An aberrant group, related to both the preceding and the following groups; these three being probably modifications of a common Cuban stock. At least two of the known forms are from the Bahamas.

Certain forms of *C. mumia* and *C. dimidiatum* show incised spiral

lines like those of the present group, though less conspicuously developed.

a. Shell conspicuously tapering, the whorls very convex. Cuban species.

b. Spire rather thick above; whorls  $9\frac{1}{2}$ – $10\frac{1}{2}$ ; alt. 17–18 mill.  
*scalarinum*, p. 223.

b<sup>1</sup>. Spire much attenuated above; whorls  $11\frac{1}{2}$ ; alt. 32 mill.  
*johusoni*, p. 223.

a<sup>1</sup>. Shell cylindric, conic above.

b. Whorls very convex, 10; teeth small; 22x9 mill.; Cuba.  
*sueyrasi*, p. 222.

b<sup>1</sup>. Whorls rather flattened.

c. Umbilicus small; ribs continued on the base; whorls  $10\frac{1}{2}$ ; 28x11 $\frac{1}{2}$  mill.; Cat Island. *felis*, p. 221.

c<sup>1</sup>. Umbilicus wide; base usually ribless; whorls 8–10; 27x12 to 21x14 $\frac{1}{2}$  mill. Berry Island, Bahamas.  
*stevensoni*, p. 220.

c<sup>2</sup>. Whorls 8; 22x11 mill. *sculptum*, p. 222.

C. STEVENSONI Dall. Pl. 44, figs. 70, 71.

Shell very variable in general form, but in general roughly cylindrical, with the nuclear whorls as it were jammed down into the blunt summit of the cylinder, with the base carinate at the periphery, where the ribs cease, and below that constricted; whorls 8–10, nuclear ones nearly smooth, gradually developing fine transverse ribbing with subequal interspaces; these become stronger, with a strong revolving thread behind the suture; at the third whorl then the diameter of the shell suddenly increases, the sides develop *strong transverse rather irregular ribbing with wider interspaces*, the ribs extending from the suture to the basal keel, beyond which they rarely extend; the base beyond the keel is constricted, rudely transversely wrinkled, inside the verge of the umbilicus centrifugally impressed and axially deeply perforate; aperture very variable in shape, with a *broad, flattish, rather thin reflected margin*; there is a parietal short lamina centrally situated and strong, but no trace of an axial fold; color light brownish or ashy to white, *the whole surface sharply spirally striated*, the striae sometimes crowded, sometimes distant. (Dall.)

Length 27, diam. 12 mill.

Length 21, diam. 14.5 mill.

Length 25.5, diam. 12 mill.

Bahamas: *Long*, or *Berry Island* (J. A. Stevenson).

*Cerion stvensoni* DALL, Nautilus, xiv, p. 65 (Oct. 1, 1900).

This species is closely allied to *C. felis* P. and V., differing from that species in the flatter, wider lip, absence of any axial lamella visible in the aperture, the much broader, somewhat funnel-shaped umbilical area, and in the sculpture of the base; the ribs in *C. felis* extending to the verge of the umbilicus, while in *C. stvensoni* they cease at a rounded cord or keel, which defines the base of the shell. Below this cord the base is very convex.

The specimen figured has 14 strong, rude ribs on the penultimate, 13 on the last whorl; on the antepenultimate whorl there are 16 ribs. As in *C. felis*, the ribs are so strong that they produce corresponding depressions on the inside of the shell; and the densely crowded rib-striae of the third whorl give way rather abruptly to the coarse ribs of those succeeding.

Figured from one of the type lot, kindly supplied by Professor Wm. H. Dall.

*C. FELIS* Pilsbry and Vanatta. Pl. 44, figs. 72, 73.

Shell strong, cylindrical, with a short but deep umbilical chink; the spire terminating in a short, straightly conic, rather acute cone; dull purplish brown. Sculpture of very strong, rough ribs, much narrower than the intervals, about 16 in number on the penultimate and next earlier whorls, the whole surface scored by deep, irregularly crowded spiral lines. Whorls  $10\frac{1}{2}$ , the first smooth, next  $1\frac{1}{2}$  obliquely striate, the rest ribbed; the last whorl has the base defined by a shallow furrow encircling below the periphery, the ribs continuing to the umbilical excavation, which is abruptly bounded by a slight ledge. Aperture angularly ovate, dull purplish-brown within, the parietal lamella compressed, moderately long, axial lamella inconspicuous; peristome rather narrowly reflexed, thickened, whitish, the parietal callus rather thin. Length 28, diam.  $11\frac{1}{2}$  mill.

Bahamas: *Cat Island* (Thos. Bland).

*C. felis* P. and V., P. A. N. S., 1895, p. 206 (June 18, 1895); 1896, p. 322, pl. 11, f. 29.

Related to *C. stvensoni* Dall, but longer, with far smaller umbilical excavation, and having the ribs continued upon the base.

*C. SCULPTUM* (Poey). Pl. 29, fig. 67.

Shell deeply rimate, cylindric-ovate, solid, dull whitish: sculptured with *strong, wide-spaced, equidistant ribs* and *closely decussated with spiral striæ*. Apex obtuse, conic. Whorls 8, rather flat, narrow, the last somewhat ascending in front, compressed at base. Aperture semi-oval, tawny within, having a parietal and a columellar lamella; peristome somewhat thickened, broadly expanded, white, the margins joined by a parietal callus. Length 22, diam. 11 mill.; aperture with peristome  $9\frac{1}{2}$  mill. long. (Poey). *Habitat unknown.*

*Pulpa sculpta* POEY, *Memorias sobre la Historia Natural de la Isla de Cuba*, ii, p. 30, pl. 2, f. 22 (1856).—*Pupa sculpta* Poey, PFR., *Monogr.*, iv, p. 656.

Close to the smaller specimens of *numia*, but differs by the spiral striæ. There are 18 ribs on the last whorl.

This species is known by Poey's description and outline figure only. The short, stout contour reminds one of the Bahaman species. The locality is unknown.

In vol. viii of the *Monographia Heliceorum*, Pfeiffer reduced this species to a synonym of *C. numia*, a course which Arango has followed, but which I think is quite erroneous.

*C. SUEYRASI* 'Blanes' PILS. and VAN. Pl. 29, fig. 68.

Shell cylindrical, solid, rimate, the lower three whorls of about equal diameter, those above forming a rather short, obtuse cone. Whorls 10, the first smooth, next finely costulate, the rest *very convex*, coarsely and *sharply ribbed*, the ribs rather high and angular, 15 to 19 in number on the penultimate whorl; *numerous rather irregular spiral striæ* revolving about the middle of the lower two or three whorls, obsolete in some specimens. Color (of specimens some time dead when collected), creamy or fleshy white. Aperture small, with small teeth; peristome expanded, subreflexed, blunt and rather thick, continued in a raised straight and rather heavy callus across the parietal margin.

Length 21, diam.  $8\frac{1}{2}$ , length of aperture  $7\frac{1}{4}$  mill.

Length 22, diam. 9, length of aperture 8 mill.

Cuba: *Vita* (Francisco E. Blanes).

*C. sueyrasi* Blanes, PILS. and VAN., *Proc. Acad. Nat. Sci., Phila.*, 1898, p. 477, fig. 6 (Jan. 13, 1899).

A member of the group of *C. scalarinum*, decidedly stouter in the

spire than *C. scalarinum* Gundl. or *C. johnsoni* Pils. and Van., and differing from *C. felis* P. and V. in the weak development of the teeth. It is decidedly longer than *C. sculptum*, with smaller aperture and more whorls.

*C. JOHNSONI* Pilsbry and Vanatta. Pl. 29, figs. 69, 70.

Shell deeply rimate, turreted, with attenuated spire, rather solid, dirty white, lusterless. Whorls  $11\frac{1}{2}$ , the first one smooth, the next 2 striate, forming a somewhat bulbous or nipple-like apex, the rest of the whorls *very convex* and sculptured with *very strong, widely separated ribs*, eleven on the penult., one or two fewer on earlier whorls; *strongly striate spirally* over ribs and intervals. Last whorl widest, the others regularly tapering, *upper portion of spire distinctly attenuated*, apex obtuse. Aperture short-ovate, white within; parietal lamella rather long but low; axial lamella small; peristome rather widely reflexed, thin, the parietal callus strong.

Length 32, diam 11, longest axis of aperture 10 mill. *Cuba.*

*Cerion johnsoni* PILS. and VAN., New species of the genus *Cerion*, p. 2 (May 4, 1895); Proc. Acad. N. S., Phila., 1895, p. 207 (June 18, 1895); 1896, p. 322, pl. 11, f. 30.—*Strophia faxoni* MAYNARD, Contrib. to Science, iii, p. 32, pl. 7, f. 1, 2 (March, 1896).

This species resembles *C. scalarinum* in sculpture, but is much larger, with the spire far more attenuated above. It is one of the most remarkable species of the genus. Named in honor of Charles W. Johnson, Curator of the Wagner Free Institute of Science.

*C. SCALARINUM* ('Gundlach' Pfeiffer). Pl. 29, figs. 65, 66.

Shell deeply rimate, oblong-turreted, moderately solid, pale flesh-tinted, the ribs whiter, surface lusterless. Whorls  $9\frac{1}{2}$  to  $10\frac{1}{2}$ , the first one smooth, following 2 densely striate, rather flattened; irregular ribs then appearing; the last  $5\frac{1}{2}$  whorls are *very convex*, and *bear strong, rounded ribs*, about 14 on the penultimate whorl; the ribs and intervals *densely and deeply engraved with spiral striæ*, which are somewhat unequal and rather roughly cut. Last 2 whorls of about equal diameter, those above regularly tapering to the *very large and obtuse* apex. Aperture rounded, the peristome white, narrowly reflexed, parietal callus rather strong, lamellæ weak, the parietal short.

Length 17 to 18, diam.  $6\frac{2}{3}$  mill., aperture with perist. 5 to  $5\frac{2}{3}$  mill. long.

Cuba: *Gibara* and *Mayari*, on the N. coast of Santiago de Cuba. *Pupa scalarina* Gundlach MSS., PFR., Malak. Bl., vii, 1860, p. 19; Monogr., vi, 292; Novit. Conch., p. 367, pl. 84, f. 16, 17 (as *P. scalaris* at foot of plate).—*Cerion scalarinum* P. and V., Proc. A. N. S. P., 1896, p. 322.—*Strophia scalarina* MAYNARD, Contrib. to Sci., iii, p. 28, pl. 6, f. 4, 5. Not *P. scalarina* Sowerby, Conch. Icon. xx, pl. 17, f. 153, error for *scalaris* Parr.

A peculiar little shell, intermediate between *C. sueyrasi* and *C. johnsoni* in contour.

#### VII. Group of *C. mumia*.

This group includes several closely related species inhabiting the northern coast of Cuba, from Bahia Honda on the west to Neuvas toward the east, and probably further in both directions. The species are cylindric, usually quite long, sculptured with rather wide-spaced ribs, which are occasionally wanting on the cone; color whitish or marbled and speckled; parietal lamella varying from rather long, the inner termination not readily visible from the aperture, to shorter or obsolete. The whorls are rather convex.

So far as known, none of the species have two forms, smooth and ribbed, like members of the group of *C. maritimum*.

1. Several lower whorls ribbed, the cone smooth or nearly so.
  - a. Shell stout, the diam. about one-third the length; usually large, white. *C. infandum*, p. 225.
  - a<sup>1</sup>. Shell slender, tapering, smaller. *C. mumia fastigatum*, p. 227.
2. All the whorls but the apical one ribbed.
  - a. Ribs narrow, 20–27 on penult. whorl; parietal callus and lamella strongly developed. Length less than  $2\frac{1}{2}$  times the diam. *C. sanzii*, p. 229.
  - a<sup>1</sup>. Ribs stronger and usually fewer.
    - b. Shell large, stout, 32x12 to 42x14 mill., with broad peristome and rather long parietal lamella. *C. mumia*, p. 225.
    - b<sup>1</sup>. Similar but small, 15–22 mill. long.
      - c. Copiously mottled with brown; whorls  $8\frac{1}{2}$ –9. *C. m. mumiola*, p. 228.
      - c<sup>1</sup>. Whitish, sometimes spirally striate; whorls  $9\frac{1}{2}$ . *C. m. hondana*, p. 228.

*b*<sup>2</sup>. Shell more slender, with very weak parietal callus and small parietal lamella or none.

*C. m. chrysalis*, p. 226.

**C. INFANDUM** ('Shuttlw.' Poey). Pl. 31, figs. 92, 93, 94.

Shell deeply rimate, very solid, cylindric, white. The *lower 2 or 3 whorls sculptured with rather strong riblets* separated by wider, often quite wide and unequal intervals; *the rest of the whorls smooth*, except that a few post-nepionic whorls usually are sharply and minutely striate. Whorls usually 11 to 12, nearly flat, the last ascending, excavated behind the columellar lip. Aperture large, light brown within, the parietal lamella quite long, axial lamella small. *Peristome very broadly reflexed*, revolute, with convex face. Parietal callus rather heavy.

Length 43, diam. 14 mill. (type).

Length 47, diam. 14 mill.

Length 39, diam. 13½ mill.

Cuba: Prov. Matanzas, at Punta Gorda (Arango).

*Pupa mumia* var.  $\beta$  PFR., Malak. Blätter, 1854, p. 203, pl. 3, f. 4, 5; Monogr. iv, p. 656.—*P. mumia* SOWB., C. Icon. f. 3b.—*Pupa decumana* FÉR., POEY, Memorias, i, p. 396.—*Pupa infanda* Shuttl., POEY, Mem., ii, pp. 29, 60.—ARANGO, Fauna Mal. Cubana, p. 100.—PFR., Monogr., vi, p. 288.—SOWB., C. Icon., pl. 2, f. 11.—*Cerion infandum* P. and V., Proc. A. N. S. P., 1896, p. 321.

Some specimens of a small form before me (fig. 94) measure 27x11, and 31½x12 mill., and have 9 or 10 whorls, agreeing otherwise with the large form.

**C. MUMIA** (Bruguère). Pl. 31, figs. 95, 96.

Shell rimate and perforate, cylindrical, solid and strong; rarely uniform white, but usually gray-brown, profusely speckled or zigzag-speckled and maculate with white. Whorls about 12, moderately convex, sculptured with strong but narrow, rather oblique ribs, separated by wide and often unequal spaces on the lower 4 whorls, which are of about equal diameter; the ribs closer and more regular on the cone, which is usually rather short and (except the first whorl), sculptured throughout. Aperture brown inside, the parietal lamella deeply placed rather strong and long. Axial lamella small, dentiform. Peristome flaring, broadly reflexed and revolute, with convex, brown-tinted face; parietal callus moderately heavy at the edge, or rather thin.

Length 35, diam.  $12\frac{1}{2}$  mill. (Bruguère's type).

Length 32, diam. 12, to length 42, diam. 14 mill. (Matanzas specimens).

Cuba: *Matanzas*. Various varieties occur along the whole *N. coast of provinces Havana and Matanzas*; and according to Arango, the entire island.

*Bulinus mumia* BRUG., Encycl. Méth., i, p. 348.—*Pupa mumia* LAM., An. s. Vert. vi, p. 105; edit. DESH., viii, p. 168.—Beck, Index, p. 82.—*Turbo mumia* WOOD, Index Testac., pl. 32, f. 111a (reduced from MARTINI's figure).—*Helix (Cochlodonta) mumia* Brug., FER., Tabl. Syst., p. 58, no. 459.—*Turbo mumia* DILLWYN, Descript. Catal., ii, p. 861.—*Strophia mumia* MAYNARD, Contrib. to Science, ii, p. 190, pl. 16, f. 3a, 3b, p. 191, f. 52.—*Strophia media* MAYNARD, iii, p. 18, pl. 4, f. 3, 4 (March, 1896).—*Cerion mumia magister* PILS. and VAN., Proc. A. N. S., Phila., 1896, p. 322, pl. 11, f. 4.

*Pupa striata* SCHUMACKER, Essai d'un Nouv. Syst. Vers, p. 230, —*Pupa manica* Lamk., DESH., Encycl. Méth., ii, p. 401 (typographical error for *mumia*).—*Pupa chrysalis* Pfr., Monogr., ii, p. 321.—KUSTER, Conchyl. Cab., p. 6, pl. 1, f. 7, 8.

Bruguère's description and the figures he cites agree best with the large form found at Matanzas. As this place was settled in 1693, it is likely that the original specimen was brought from thence. I do not know that this form occurs at any other locality.

Typical *mumia* is larger than *chrysalis*, more cylindrical, with the peristome more broadly flaring and recurved, and the parietal lamella usually better developed and quite long. It is sometimes reinforced by a callus or small tooth united to its left side.

Fig. 95 of pl. 31 represents a specimen corresponding in size with the original type. Fig. 96 is a larger shell.

Form *medium* Maynard (pl. 31, fig. 97), described from two specimens labeled "Cuba," differs from *mumia* by the smaller size with rather narrower lip. It is "yellowish white, marked everywhere with longitudinal, zigzag lines of reddish-brown, which are occasionally broken into lines." Length 30, diam.  $12\frac{1}{2}$  mill.

Var. *CHRYSALIS* Férussac. Pl. 31, figs. 98, 99, 1, 3, 4, 5.

Thinner and more slender than typical *C. mumia*, with the termi-



nal cone longer. Whorls about 11, strongly ribbed, the spaces wider than the ribs; this *sculpture extending upon the cone* to the first whorl. White, sometimes uniform, but typically *marbled with zigzag stripes* and fine transverse markings of purple-brown. Aperture rather small, brown inside, the *parietal lamella very small or wanting*, rarely of moderate size; lip reflexed, not so wide as in *mumia*; *parietal callus generally thin*, often scarcely interrupting the ribs. Size variable:  $31\frac{1}{2} \times 10\frac{1}{2}$ ;  $33 \times 9\frac{1}{2}$ ;  $26 \times 11$  mill. (Morro Castle, Havana).  $33$  to  $37 \times 12$ ;  $31$  to  $34\frac{1}{2} \times 10$ ;  $25\frac{1}{2} \times 9$  mill. (Carmelo, near Havana).  $34 \times 10\frac{1}{2}$ ;  $28 \times 11$ ;  $27 \times 10\frac{1}{2}$  (Marianao, near Havana).

*Northern coast of Provinces of Havana and Matanzas.*

*Helix chrysalis* FER., Hist., pl. 153, f. 1-7.—*Pupa chrysalis* FÉR., DESHAYES, An. s. Vert., viii, p. 181; and in FÉR., Hist., ii, p. 205.—KUSTER, Conchyl. Cab., p. 110, pl. 15, f. 1, 2.—BECK, Index, p. 82, with varieties *normalis* (FÉR. Hist., pl. 53, f. 1-3), *edentula* (f. 4) and *bidens* (t. c., f. 5).—POT. & MICH., Galerie, ii, p. 163, pl. 16, f. 9, 10.—SOWB., C. Icon. pl. 1, f. 5.—*Pupa mumia* BRUG., DESH., in FÉR., Hist., ii, p. 208 (description and figures, but exclusive of part of synonymy).—KUSTER, Conchyl. Cab. p. 4, 110, pl. 1, f. 1, 2; pl. 15, f. 3, 4.—*Pupa mumia* BLAINV., Malacol. p. 458, pl. 39, f. 5.—*Pupa sulcata* SOWB., Genera of Shells, fig. 4; the same plate printed in REEVE, Conchol. Syst., ii, pl. 170, f. 4.—*Strophia chrysalis* FÉR., MAYNARD, Contrib. to Sci. iii, p. 1, pl. 1, f. 1, 2.—*Strophia scripta* MAYNARD, Contrib. to Sci. iii, p. 3, pl. 1, f. 3, 4.—*Strophia scripta obliterated* MAYN., Contrib. to Sci. iii, p. 5, pl. 1, f. 5, 6.—*Strophia fastigata* MAYN., Contrib. to Sci. iii, p. 6, pl. 2, f. 1, 2.—*Strophia eurystoma* MAYN., Contrib. to Sci. iii, p. 7, pl. 2, f. 3, 4.—*Strophia eurystoma ignota* MAYN., Contrib. to Sci. iii, p. 9 (March, 1896).

There can be little doubt that the type locality of *chrysalis* was Havana; specimens agreeing in all respects with Férussac's figures being abundant in that neighborhood. Figures 1 to 7 of Férussac's plate 153 represent forms of this variety, but the figures 7, 8 on his plate 156 are probably *C. marmoratum*.

Specimens from Morro Castle, Havana (pl. 31, figs. 2, 3, 4), are mostly rather thin, with the parietal lamella small or obsolete, and the lip and parietal callus generally thin. They vary from uniform dirty-white to profusely marbled. These are typical *chrysalis* and probably from the original locality.

Specimens from Marianao (pl. 21, figs. 99, 1) and Carmelo (fig. 98) often have the peristome much more thickened than most of those from Morro Castle. At Carmelo Mr. Rhoads found the thick-lipped form, the form *fastigata*; and very long, slender, blue-white shells (pl. 31, fig. 98) in which the cone is feebly costate. Whether these three forms occurred together or were locally segregated I do not know. The ribs are very widely and unequally spaced in some examples from this place.

*Strophia scripta* Maynard (pl. 31, fig. 8) from Cardenas, seems to have no differential characters to separate it from Havana *chrysalis*. The teeth are subobsolete, peristome thin and narrow, and color "bluish white, beautifully marked with rather longitudinal patches of deep purplish brown, which often overlie the striations as well as the interspaces. These brown marks are encroached upon on either side by alternating lines of white." *Strophia scripta obliterated* Maynard (pl. 31, figs. 6, 7), from Matanzas, on rocks close to the sea, differs from *scripta* "by the smaller size and the often nearly obliterated markings." It varies from pure white to a rich reddish or purplish brown with delicate horizontal lines of white, and from a cylindric to a tapering form.

Form *eurystoma* Mayn. (pl. 31, fig. 9). A yellowish white shell with the apex flesh-colored, interior pale brown, mouth large, with small teeth. Ribs rather distant, 16 on the last whorl. Length 34, diam.  $11\frac{3}{4}$  mill., to  $30\frac{3}{4}\times 9$  mill. Havana.

Form *fastigatum* Maynard (pl. 31, figs. 10, 11, 12). Shell having the contour of *C. mumia chrysalis*, cylindric or tapering. Fleshy or bluish white, either uniform or zigzag-marked with gray-brown, as in *chrysalis*. Lower 3 to 5 whorls ribbed as in *chrysalis*, the whorls of the cone almost smooth. Aperture and peristome as in *chrysalis*, the parietal lamella small or subobsolete.

Matanzas; Chorrera and Carmelo, near Havana.

This form has the shape of *chrysalis*, but the ribs disappear above as in *infanda*. It occurs both white and marbled. The number of ribless whorls varies. Sometimes only the last  $2\frac{1}{2}$  are ribbed, while other specimens have more ribbed whorls and establish a complete transition to *chrysalis*, with or near which it occurs at Matanzas. At Carmelo the two were found together. It is probably not a racial variation.

In my opinion, *Strophia eurystoma ignota* of Maynard, from

Havana, is completely identical with *C. fastigatum*, which Maynard himself reports from "Chorrea," an error for Chorrera, a village situated a few miles from Havana.

Figures 11, 12 are from Chorrera specimens, fig. 10 from Carmelo. It occurs both white and marbled at both localities.

Var. *hondana* Pilsbry. Shell cylindric or tapering, ribbed as usual to the nepionic whorl, 17–23 ribs on the penult. whorl; sometimes cut by engraved spiral lines, as in the group of *C. scalarinum*. White, with sparse and indistinct gray markings. Whorls  $9\frac{1}{2}$ , moderately convex: lip reflexed, the parietal callus thin inside, the ribs showing through. Parietal tooth minute or obsolete. Length  $20\frac{1}{2}$ , diam.  $8\frac{1}{2}$  mill.

*Bahia Honda.*

The occasional development of engraved spirals shows how closely the *mumia* group is related to the *scalarinum* group, through such forms as *hondana* and *suegrasi*.

Subsp. MUMIOLA (Pfeiffer). Pl. 29, figs. 62, 63, 64.

Shell shortly and deeply rimate, oblong-cylindric, rather solid, closely marbled with white and corneous-brown; sculptured throughout with rather spaced and narrow longitudinal riblets, separated by wider intervals, and about 15 to 20 in number on the penult whorl. Cone of the spire short; last 3 whorls of about equal diameter. Whorls  $8\frac{1}{2}$ –9, somewhat convex. Aperture truncate ovate, brown within; parietal lamella small and rather short; axial lamella tooth-like; peristome white, typically rather narrowly reflexed but in a large form of the species it is very broad. Parietal callus thin and transparent.

Length 20, diam. 9, oblique height of apert. 9 mill. (Pfr. type).

Length 18, diam. 8 mill.

Length 21, diam. 8 mill.

Cuba: Matanzas, at "Playa de Indias" (Pfr.).

*Pupa mumiola* PFR., Archiv f. Naturg. 1839, i, p. 353; Monogr. ii, p. 324; iii, 539; iv, 656; vi, 288; Mal. Bl. i. p. 204, pl. 3, f. 6–8.—POEY, Memorias ii, p. 60, pl. 5, f. 21 (genitalia).—KUSTER, Conchyl. Cab. p. 90, pl. 13, f. 1, 2 (figs. of type).—*Cerion mumiola* and *C. m. major*, P. & V., Proc. A. N. S. Phila. 1896, p. 322.—*Cerion (Maynardia) mumiola* Pfr., DALL, Bull. Lab. Nat. Hist. State Univ. of Iowa, iv, p. 21 (1896).—*Strophia mumiola* Pfr., MAYNARD, Contrib. to Science iii, p. 16, pl. 4, f. 1, 2.

Fig. 62 is a copy of the type figure. Other specimens are smaller, 15x7 mill., and still others larger, with very broadly reflexed peristome and  $9\frac{1}{2}$  whorls (fig. 63).

Pfeiffer finally thought *mumiola* a form of *C. mumia*, an opinion shared by Arango, and in which I agree. The only differences are that *mumiola* is smaller, with fewer whorls; but I have not yet seen actual intergradation. According to Poey the flagellum is longer in *mumiola* than in *mumia*.

Dall reports it from the westernmost one of the Florida Keys, remarking that "the occurrence on Tortugas is probably the result of transportation by sea drift. If living at Tortugas it would add a new species to the fauna of the United States."

C. SANZI 'Blanes' P. & V. Pl. 29, figs. 54, 55, 56.

Shell rimate, solid and strong, cylindric-conic. White, very sparsely and inconspicuously mottled with pale blue-gray or brown; lusterless, the ribs rather glossy. Lower three whorls of about equal diameter, those above forming a rather long cone terminating in an obtuse apex. Whorls 10–11 $\frac{1}{2}$ , the first smooth, the rest ribbed; ribs rather strong, narrow, separated by far wider interstices, 20–27 on the penultimate whorl, frequently irregular or in part obsolete on the last whorl, split on the base into an irregular striation. Aperture irregularly ovate, the throat brown; peristome reflexed, more or less thickened, the terminations joined by a *heavy parietal callus*. Parietal lamella deep within, strong and rather long; columellar tooth well marked.

Length 27, diam. 11 $\frac{1}{2}$ , length of aperture 10 mill.

Length 23 $\frac{1}{2}$ , diam. 10 $\frac{1}{2}$ , length of aperture 9 mill.

Cuba: *Confites Key*, Nuevitas, N. shore of prov. Puerto Principe.

*Cerion sanzii* Blanes, PILLS. & VAN., Proc. Acad. Nat. Sci. Phila. 1898, p. 478, fig. 9.

This species has considerable resemblance to *C. chrysalis*, but differs in the strong development of the parietal lamella, which is long, as in typical *C. mumia*, and in the narrower ribs. In some specimens the interior of the aperture is mainly white, the brown appearing far within. In one shell of the type lot there is a small accessory denticle to the left of the main parietal lamella, and partially united with it. This doubling of the parietal lamella occurs occasionally in *C. mumia* and many other species.

VIII. Group of *C. regina*.

*Strophlops* DALL, Bull. M. C. Z. xxv, no. 9, p. 121, type *C. regium*.

The shell is usually rather large, *cylindric or column-shaped*, varying from smooth to ribbed. The umbilical rima is usually long, often perforate, and there is a large excavated area behind the columellar lip. The aperture is rather long, peristome expanded and reflexed, but its face is not thickened or built forward. Parietal tooth varies from a third of a whorl long to short. The parietal callus may be heavy, but does not form a raised ledge. The young, in *C. regina*, have an open, trapezoidal aperture with no teeth except a small columellar plait. The species are from the southeastern Bahamas. This group is closely allied to the Cuban group of *C. mumia*.

1. Species of Tark's Island: *C. regina* and varieties, *C. incanoides*.

2. Species of the Inagua group: *C. calcureum*, *C. sarcostomum*, *C. columna*.

3. Species of the Crooked Island group and Long Island: *C. regium*, Castle Island. *C. weinlandi*, Crooked Island. *C. inflatum*, Acklin Island. *C. nudum*, Long Island.

The several forms from each island group are very closely related. The variation in sculpture in *C. columna* and *regina* is extraordinary. Species of the third sub-group are smooth or nearly so.

*C. REGINA* Pilsbry & Vanatta. Pl. 35, figs. 27, 28, 29, 30.

Shell thick, subcylindrical, gradually tapering above, the long terminal cone passing gradually into the cylindrical portion; lower 3 whorls of about equal diameter; apex obtuse; earlier whorls not striate; chalk-white and dull, the smoothness of the surface but little broken by slight growth-lines, the basal whorl irregularly and rather distantly costate, at least on its latter half. Whorls 10 to  $10\frac{1}{2}$ , flat, with superficial seam-like sutures. Last whorl suddenly ascending in front, much compressed and pinched toward the base. Umbilicus open or perforate, with the usual arcuate rima, below which it is broadly excavated and flattened. Aperture oblong-cordate, slightly less than one-third the length of shell, higher than wide, dark or light brown within, rarely purplish. Peristome expanded and reflexed, its face convex but not much thickened, whitish, parietal callus moderate, its outer edge not raised. Axial lamina situated

high, narrow and inconspicuous from in front. Parietal lamella low, small, varying from moderately short to long, central in position.

Length  $31\frac{1}{2}$ , diam.  $11\frac{3}{4}$  mill.

Length 33, diam.  $12\frac{1}{2}$  mill. (average typical specimen).

Length 38, diam. 13 mill.

Bahamas: *Turk's Island* (Gabb, Swift).

*C. regina* P. & V., Proc. Acad. Nat. Sci. Phila. 1895, p. 208 (June 18), with varieties *percostata*, *comes*, *swiftii*, *eucosmia* and *brevispira*; 1896, pp. 320, 330, pl. 11, f. 23, 24; with varieties *comes* (p. 320), *eucosmium* (p. 321, pl. 11, f. 21), *percostatum* (p. 321, pl. 11, f. 22), *swiftii* (p. 321) and *brevispirum* (p. 321, pl. 11, f. 25)—? *Pupa maritima* Sowb., Conch. Icon. xx, pl. 3, f. 20.

This species is allied to *C. regium*, which it resembles in the conspicuous excavation or flattening of the last whorl below the umbilical groove, and in the usually more or less open umbilicus.

Form *percostatum* P. and V. Pl. 34, fig. 12.

Form of shell and mouth as in *C. regina*; but the whole surface except the nepionic apex is *regularly ribbed*, as in *C. album* Mayn., except that the ribs on the cylindrical portion are wider spaced. White, much mottled and clouded with brown. Holds the same relation to *C. regina* that *album* holds toward *lentiginosum*. Length  $35\frac{1}{2}$ ; diam. 13 mill.; often smaller in the same proportions, or comparatively wider. Mouth longer than in *C. album* Mayn. Turk's Island.

Form *comes* P. and V. Pl. 34, fig. 16.

Shell with the form, size and sculpture of *C. regina*, but coloring of *C. lentiginosum* Mayn.; heavily streaked and marbled with chestnut brown, on the cone finely speckled and zigzagged. Turk's Island. (Swift, Gabb, *et al.*)

Form *swiftii* P. and V. Pl. 34, figs. 13, 14.

Shell with the elongated form and large, excavated umbilical tract of *C. regina*, but smaller, thinner, *distinctly tapering* from the body-whorl upward; parietal callus very heavy in adults, parietal lamella low, deep-seated. Last two whorls rather distinctly ribbed. Color varying from white, to chestnut, streaked and speckled with white. Length 26, diam. 10 mill. Turk's Island. (C. Blume, in Robert Swift collection, A. N. S.)

Form *eucosmium* P. and V. Pl. 34, fig. 11.

Shell with the form and size of *regina*, but *smooth, glossy, ribless*, or with a few irregular ribs on body-whorl; livid, pinkish-brown or gray-brown, profusely streaked and marbled with white.

Form *brevispirum* P. and V. Pl. 34, fig. 15.

Shell *short*, pupiform, compact; lower two whorls of equal diameter, those above tapering to form a short cone. Whorls 8-9, all but the last one smooth, the last more or less ribbed; umbilical chink deep, the area below it excavated. Aperture much exceeding one-third the length of shell, ovate, *purple within*; peristome narrowly reflexed, not thickened, white; parietal callus imperceptible; parietal lamella small, rather short, deep-seated. Axial lamina small. White, boldly streaked and blotched, and marbled with rich brown. Alt. 22, diam. 10 mill. or smaller. Apert., alt. 9.5; width 8.3 mill. Turk's Island. (W. M. Gabb.)

This form looks very distinct from *C. regina*, and we have no intermediate specimens; but it occurs on the same small island, and will probably prove to be only a sub-species of that form.

*C. INCANOIDES* Pilsbry & Vanatta. Pl. 35, figs. 25, 26.

Shell resembling *C. incanum* in general aspect. Thin, cylindrical, the lower three whorls of equal diameter, those above forming a convex, obtuse cone; deeply rimate, with a rather large excavated area behind the flaring columellar lip. Surface nearly smooth, as in *C. incanum*; white or fleshy-white, the two nepionic whorls corneous brown, the following whorls of cone finely variegated with zigzag brown marking and speckling, or without such markings. Whorls  $9\frac{1}{2}$  to 10, nearly flat, the last with a few rather strong folds or ribs on its latter half. Aperture brown within, peristome reflexed, a little recurved, the parietal callus moderate or thin, without raised edge. Parietal lamella slender but rather long; axial lamella small.

Length 30, diam. 11, length of aperture 11 mill.

Length  $25\frac{1}{2}$ , diam. 9, length of aperture  $10\frac{1}{2}$  mill.

Length 24, diam.  $8\frac{1}{2}$ , length of aperture  $10\frac{1}{3}$  mill.

Bahamas: *Turk's Island*.

*C. incanoides* P. & V., Proc. Acad. Nat. Sci. Phila., 1895, p. 209; 1896, p. 320, pl. 11, f. 15.

Curiously like *C. incanum* superficially, but differing in the larger

excavated area behind the columellar lip. It is closely related to *C. regina*.

*C. CALCAREUM* (Pfeiffer). Pl. 34, figs. 1, 2.

Shell deeply rimate, subcylindric, solid; irregularly striate, glossy, calcareous; spire long, the apex obtusely conic. Whorls 12, nearly flat, the last inflated, wrinkle-plicate in front, ascending. Columella simple. Aperture semi-oval, white within, brownish in the throat; peristome strongly thickened, expanded throughout, white, the margins joined by a glossy callus, columellar margin sinuate-reflexed above. Length 38, diam. 12 mill.; aperture with peristome 14 mill. long, 12 wide (Pfr.).

*Habitat unknown* (Pfr.); *Little Inagua* (Sargent).

*Pupa calcarea* PFR., Zeitschr. f. Malak. 1847, p. 83; Monogr. ii, p. 315.—KÜSTER, Conchyl. Cab., p. 157, pl. 19, f. 4, 5.—*Strophia calcarea* Pfr., BLAND, Ann. Lyc. of Nat. Hist. of N. Y., xi, p. 85.

Close to *C. sarcostomum*, which may prove to be a ribbed form of the same species. Bland is responsible for the identification of specimens collected by Mr. D. Sargent on Little Inagua, thus giving a locality for the species, before of unknown habitat. I have not seen specimens.

*C. SARCOSTOMUM* Pilsbry & Vanatta. Pl. 34, figs. 3, 4.

Shell solid and strong, subcylindrical, or slightly wider below; white or whitish pink. Whorls 11 to  $11\frac{1}{2}$ , slightly convex, the earlier 6 forming a convexly tapering cone with *extremely obtuse apex*, almost dome-shaped at top; passing gradually into the cylindrical portion of shell, *which consists of 5 to 6 whorls*. Sculpture of somewhat irregular and unequal, straight ribs, about as wide as the intervals, about 25–30 on the last whorl. These ribs are strongly developed on the cylindrical portion of the shell, but the cone is very densely, finely and sharply striated, the earliest whorl only being smooth.

Aperture *small*, less than one-third the total length of shell, pinkish-flesh colored in the throat; peristome well reflexed, recurved, more or less thickened on the inner edge of the face; *parietal callus thick and heavy*. Parietal lamella rather strong and moderately long; axial fold moderately conspicuous.



Length 34, diam.  $11\frac{1}{2}$ ; alt. of aperture 10 mill.

Bahamas: *Little Inagua*.

*C. sarcostomum* P. & V., Proc. A. N. S. Phila., 1896, pp. 321, 331, pl. 11, f. 16 (August 4).

Some specimens are larger than the above dimensions; one worn and broken "crab-shell" would probably be not less than 40 mill. long if perfect. It is not unlikely that forms occur with the ribs obsolete, as in the allied *C. columna*, but all the specimens seen are strongly ribbed.

*C. sarcostomum* clearly belongs to the immediate group of *C. calcareum* and *C. columna*. The latter has a very dark aperture, broadly flanged lip and less obtuse apex. *C. calcareum* lacks sculpture except on the basal whorl, is absolutely cylindrical, with light mouth and excessively short terminal cone, while the present species is more tapering, with the cone decidedly longer, gradually passing into the cylindrical portion.

*C. COLUMNA* Pilsbry & Vanatta. Pl. 34, figs. 5, 6, 7.

Shell deeply rimate, thick, strong, cylindrical or column-shaped, the later four or five whorls of about equal diameter, those above tapering, forming a cone one-fourth or one-fifth the shell's length. Bluish white, often flesh-tinted on the cone. Whorls 12-15, the first 2 smooth, several following whorls closely and distinctly striate; the median whorls either smooth or having irregular, wide-spaced ribs; the last whorl with stronger ribs, at least on its latter half. The sutures, which are seam-like on the earlier portion, become somewhat impressed between the whorls of the cylindric portion. Aperture ovate, *dark purplish-brown, chestnut-brown or orange brown inside*, obstructed by a moderately long, pale brown parietal lamella and a deeply entering oblique columellar lamella; peristome white or nearly so, broadly reflexed, the terminations joined by a thick and strong parietal callus.

Length 46, diam.  $12\frac{1}{2}$  mill. Length  $41\frac{1}{2}$ , diam.  $14\frac{1}{2}$  mill.

Length 38, diam.  $13\frac{3}{4}$  mill.

Bahamas: *Turtle Cove, Great Inagua*. (Sargent.)

*Strophia iostoma* Pfr., BINNEY, Annals of the Lyceum of Natural History of New York, xi, 1876, p. 31, pl. 2, f. 8; Ann. N. Y. Acad. Sci., iii, 1884, p. 101, pl. 7, f. c. (jaw and teeth).—BLAND, Ann. Lyc., xi, p. 85. Not *Pupa iostoma* Pfr.—*Cerion columna*

PILS. & VAN., Proc. Acad. Nat. Sci., Phila., 1895, p. 207, with var. *valida*; 1896, p. 321, pl. 11, f. 17, and var. *valida*, pl. 11, f. 18.

This species has some resemblance to the Cuban *C. infandum*, but differs in the dark mouth. *C. calcareum* is more obtuse above, with pale aperture. *C. sarcostomum* of Little Inagua is an allied form with smaller, pale aperture and much less dilated umbilical excavation. Var. *validum* P. & V. Pl. 34, figs. 8, 9, 10.

Smaller and rather thin, ribbed throughout; more or less copiously maculate with dusky purple, or with the intervals of this color. Aperture dark as in the type. Length 34, diam. 10–12 mill.

*C. REGIUM* (Benson). Pl. 35, figs. 17–24; pl. 47, fig. 40.

Shell large, very deeply umbilicate, long-conic, subcylindrical, solid, white, smooth, a little glossy; obliquely and remotely and obsoletely plicate-striate. Spire noticeably tapering above, the apex rather obtuse; umbilicus perforating. Whorls 11, somewhat flattened, the last ascending in front, more strongly plicate, compressed at the base; suture linear, irregularly crenate. Aperture obliquely truncate-ovate, sublateral, sloping away from the axis, fulvous within; columellar fold deep within, doubled; parietal fold elongate, rather deeply placed; peristome heavily thickened, reflexed, wide below, the margins joined by a callus; columellar margin expanded, sinuate above, its outer edge forming an angle; right margin arched forward. Length 43, diam. (measured to edge of outer lip) 23 mill.; aperture with peristome 18 mill. long, 13 wide (*Benson*).

Bahamas: *Castle Island*, at the southern extremity of the Crooked Island Bank.

*Pupa mumia* SOWERBY, The Genera of Shells, *Pupa*, f. 2; reprinted in REEVE, Conchologia Systematica ii, pl. 170, f. 2.—*Pupa regia* BENSON, Ann. & Mag. Nat. Hist. (2), iv, p. 125.—KUSTER, Conchyl. Cab. p. 134, pl. 17, f. 13, 14.—PFR., Monogr. iii, 538.—*Strophia regia* MAYNARD, Contrib. to Sci. iii, p. 37, pl. 5, f. 8, pl. 7, f. 5, 6.—*Cerion regium* Bens., PILS. & VAN., Proc. A. N. S. Phila. 1896, p. 321.

*Helix* (Cochlodonta) *decumanus* Fér., (nude name) Prodr., p. 59, no. 462, according to his specimens, but not his "var. *a*," which alone is defined.—*Pupa decumana* Fér., PFR., Monogr. iv, p. 655; vi, 288.—CROSSE, Journ. de Conchyl. 1868, p. 337.—*Strophia decumana* Fér., BINNEY, Ann. Lyc. Nat. Hist. of N. Y., x, p. 384

(1873); Proc. Acad. Nat. Sci. Phila. 1874, p. 53, pl. 8, f. 1 (dentition); Ann. N. Y. Acad. Sci. iii, p. 100, pl. 7, f. A.—*Cerion* (*Strophlops*) *decumanum* Fér., DALL, Bull. Mus. Comp. Zool. xxv, no. 8, pp. 122, 124, fig. 4.

Not *Pupa decumana* Fér., PFR., Monogr. Hel. Viv. ii, p. 320, 1848 (except references to Sowerby and Reeve), nor of GRAY, Ann. of Philos. (New Ser.) 1825, xi, p. 413 (no description; referring to Lister, pl. 588, f. 47, a species resembling *multicosta*).

The largest species of the genus. It is closely allied to *C. weinlandi*, from which it differs in the large size, snowy whiteness and the broader area behind the columellar lip.

Benson's original description is given above. The shells are usually more cylindrical than his type (pl. 35, f. 22, 23); very solid, snow-white, the throat generally tawny. The last whorl is more or less plicate dorsally. The parietal lamella is long, making about one fifth of a spiral turn. The axial lamella generally ascends nearly 3 whorls. Size varies within wide limits, as follows:

Length  $46\frac{1}{2}$ , diam. 17, long axis of aperture  $19\frac{1}{2}$  mill.; whorls 11.

Length 45, diam. 15, long axis of aperture 18 mill.; whorls 11.

Length 37, diam. 15, long axis of aperture  $15\frac{1}{2}$  mill.; whorls  $10\frac{1}{2}$ .

Length 34, diam.  $14\frac{1}{2}$ , long axis of aperture 15 mill.; whorls  $9\frac{1}{2}$ .

Crosse has attempted to revive the name *decumana* for this species, showing that the specimens in Férussac's cabinet were identical with *regia* Bens.; but *P. decumana* was in no way defined by Férussac, and was introduced by Gray in 1825 for a shell resembling *multicosta*, this interpretation of the species being followed by Pfeiffer in his earlier description. The course taken by Crosse was therefore clearly inadmissible.

Pl. 35, figs. 22, 23, are copies of Küster's figures of Benson's type specimen. Fig. 24 is Sowerby's "*P. mumia*," a broader shell than any I have seen. Figures 17–21 are from Castle Island specimens in the collection of the Academy.

*C. WEINLANDI* ('Kurr' Martens). Pl. 37, figs. 54, 55, 56, 57.

Shell deeply and openly rimate, often perforate, cylindric, solid, white or flesh-colored, *nearly smooth*. Whorls  $9\frac{1}{2}$  to 10, nearly *flat*, marked with slight growth-wrinkles, the last often irregularly plicate behind the aperture, compressed and obtusely keeled below; last 3 or 4 whorls of about equal diameter, those above forming a short

cone with obtuse apex. Aperture ovate, the peristome reflexed and recurved, somewhat thickened on the convex face; parietal callus thin, with ill-defined edge. *Parietal lamella long*, as in *C. regium*; axial lamella moderate.

Length 25–35, diam. 11–14, aperture 14 mill. (types).

Length 33, diam. 12, aperture 14 mill.

Length  $27\frac{1}{2}$ , diam.  $10\frac{1}{2}$ , aperture  $11\frac{1}{4}$  mill.

Bahamas: *Crooked Island*.

*Pupa weinlandi* Kurr, MARTENS, Malak. Blätter vi, 1859, p. 207 (Jan., 1860).—PFR., Monogr. vi, p. 290; Novit. Conch., p. 363, pl. 84, f. 1, 2.—Apparently not *P. weinlandi* SOWERBY, C. Icon. xx, pl. 3, f. 24 (1875).

This species is evidently of common ancestry with *C. regium* of the same immediate island group. It differs from that in the smaller size, less spreading umbilical excavation and thinner shell.

*C. nudum* (Maynard). Pl. 37, figs. 50, 51.

Size medium; shell thin; teeth two, short; striations absent; whorls 10 and 11. Form of shell cylindrical, the first [last] 4 whorls being about equal in diameter, then the shell curves to a blunt point, making an angle of 65 degrees. There are only faintly defined lines of growth, which are more prominent on the upper [last] whorl; sutures deep, with whorls bulging. Aperture large and open; lower [parietal] tooth placed to right [left] of center, is not prominent, and is .1 inch long by .03 high; the upper [axial lamella] is a mere elevation at the entrance, is larger within, but is short. Margin not produced forward quite as far as the diameter of shell, and is inclined slightly to the right; it is thin. Frontal bar [parietal callus] not large. Color of shell externally and internally dark flesh, yellowish at apex, and fading to nearly white on margin and teeth; shell polished (*Maynard*).

Length 25, diam. 10; length 22.2, diam. 9.5 mill.

Bahamas: *near Clarence Harbor, Long Island*. (C. J. Maynard.)

*Strophia nuda* MAYN., Contrib. to Sci., i, p. 29, pl. 2, f. 12 (April, 1889).

Resembles *C. weinlandi* somewhat, but is smaller, with short parietal lamella, and convex whorls. It is a smooth, flesh-colored shell. Described from 3 specimens in coll. Maynard.

**C. INFLATUM** (Maynard). Pl. 37, figs. 52, 53.

"Size medium; shell heavy; striations are absent. Whorls 10. Teeth, two, and short. Examined 25 specimens. Form of shell cylindrical, with the second [penult.] and third [antepenult.] whorls the largest in diameter, the first [last] and fourth [from the base] are a little smaller, the fifth [from the base] is considerably smaller than the fourth, and from this the shell slopes rapidly to a blunt, rounded, nearly hemispherical apex, forming a wide angle of nearly 90 degrees. The surface is polished but is slightly furrowed with lines of growth, which are much less prominent on the lower [earlier] whorls. The sutures are shallow, and the whorls between them are slightly bulging.

"Aperture of medium size but open, and measures considerably more just within than at the entrance. Lower [parietal] tooth very slightly developed and is raised by gradual elevation from the surrounding surface. It is about .10 in. long. The upper [columellar] is situated considerably above, is about as prominent, but is more conspicuous within. Margin not produced forward as far as the diameter of the shell, is inclined slightly backward and a little to the right; it is not thickened, and the outer portion is produced into a thin but not prominent edge which is not rolled downward. The frontal bar is not prominent, being interrupted in the middle.

"Color of shell externally white, conspicuously striped with yellowish-brown that becomes nearly yellow on the lower whorl, and which occupies the last two, wholly excluding the white. The margin, frontal bar, and teeth are yellowish, and on the lower wall, within the aperture, are purplish-brown stripes that merge into the universal purplish-brown of the interior." (*Maynard.*)

Length 22.5, diam. 8.75 mill.

Length, 25, diam. 9.25 mill.

Bahamas: *Salena Point, Acklin Island* (Dr. Henry Bryant).

*Strophia inflata* MAYN., Contrib. to Sci., i, p. 126, f. 30, pl. 7, f. 21 (October, 1889).

Apparently well marked by the heavy, smooth, copiously striped shell and the inflated spire, the penultimate whorl being wider than the last, the next earlier whorl frequently wider than the penult. Types are in coll. Maynard and Boston Society of Natural History. Specimens labelled *Exuma* are in the collection of the Smithsonian Institution, according to Maynard (Contrib., i, p. 133).

IX. Group of *C. gubernatorium*.

Shortly rimate shells, *tapering*, oval or sometimes cylindric, the upper part generally smooth, last whorl or two usually ribbed; parietal tooth usually somewhat *long*; peristome built forward and beveled when thick, the parietal callus either appressed or forming a raised ledge.

These forms are never strongly and regularly ribbed like species of the group of *C. glans*, but they are clearly related to that group by the frequently beveled lip which may be built forward, the occasionally ridge-like parietal callus, and the short umbilical chink. Some forms have a blue streak at the base such as is frequent in *C. glans*. They inhabit keys and islands of the Great Bahama Bank, from Eleuthera and New Providence on the northeast, southward to Exuma, and in the west, some small keys bordering Florida Strait.

a. Parietal callus forming a strong, raised ridge.

b. Finely striate. Duck Key, Exuma Group.

*C. milleri*, p. 243.

b<sup>1</sup>. Last whorl ribbed. New Providence. *C. agassizi*, p. 242.

a<sup>1</sup>. Parietal callus appressed, not ridge-like.

b. Interior, and usually the lip, brown.

c. Shell smooth, or with the last whorl striate; rather thin, usually variegated. New Providence.

*C. gubernatorium*, p. 242.

c<sup>1</sup>. Last one or several whorls ribbed; stouter; generally whitish. Eleuthera. *C. eleutherae*, p. 240.

c<sup>2</sup>. Nearly smooth, whitish. Water Cay.

*C. niteloides*, p. 244.

b<sup>1</sup>. Interior and lip white; parietal tooth small. Gun Cay.

*C. pillsburyi*, p. 244.

C. ELEUTHERÆ Pilsbry and Vanatta. Pl. 36, figs. 35, 36, 37, 38.

Shell solid and strong; *smoothish above, ribbed below*; lusterless; white, with a bluish-purple tint, most obvious around the base. Cylindric-tapering, terminating above in a rather long slightly convex-sided cone which passes gradually into the cylindrical portion, or the whole shell may taper to the last whorl. Apex obtuse; whorls  $10\frac{1}{2}$  to  $12\frac{1}{2}$ ; nepionic  $2\frac{1}{2}$  whorls nearly smooth, slightly convex; following *whorls of the cone smoothish* to the naked eye, showing rather

irregularly spaced wrinkles under the lens, *flat*, with seam-like *sutures*, *not in the least impressed*. Latter 4 whorls approaching equality in diameter, subregularly and rather strongly costate (at least the lower two whorls), the last one with about 27 (22 to 30) ribs, which do not split or double on the base, although sometimes there are some riblets intercalated there.

Aperture about one-third the shell's length, oblong or rounded, obliquely truncate above, liver-brown within. Peristome white, reflexed, the outer edge sharp and somewhat recurved, *inner edge built far forward, especially below*, beveled outwardly; parietal callus either very thin or thick. Axial fold variable in prominence; parietal lamella very strong, rather long. Axis perforate, with a rather short rima.

Length 29, diam.  $11\frac{1}{2}$ ; alt. of aperture 11 mill.

Length 33, diam. 11; alt. of aperture 11 mill.

Length  $23\frac{1}{2}$ , diam. 11; alt. of aperture 9 mill.

Bahamas: *Eleuthera* (Krebs and others).

*C. eleutherae* P. and V., P. A. N. S., 1896, p. 333, pl. 11, f. 19, 20.—*Pupa gubernatoria* var.  $\beta$  CROSSE, J. de C., 1869, p. 186; 1870, p. 106, pl. 2, f. 4 (upper figure).

This species is closely allied to *C. agassizi* Dall and *C. gubernatorium* Crosse, of the island of New Providence. It has more remote resemblance to *C. sarcostomum* P. and V. of Little Inagua.

From *C. agassizi* it differs in never having the parietal callus raised in a strong ridge making the peristome continuous; the ribs are less sharp and narrow, etc. *C. gubernatorium* has a proportionally very large mouth, less thickened lip, finer riblets or none, the parietal tooth is shorter, and the surface glossy; moreover, while nearly white examples occur, it is generally much variegated. There can be no doubt of the close relationship of the three species, but judging from a series of 25 examples of *C. eleutherae*, a good series of *C. gubernatorium* and author's examples of *C. agassizi*, they are specifically distinct.

A pair of specimens of *C. eleutherae* before us (from Krebs) are considerably streaked with brown, otherwise typical. Another specimen, received from Mr. Van Nostrand, is very small, alt.  $18\frac{2}{3}$ , diam. 8 mill., and somewhat maculated. The costulation extends further up, and the peristome is not thickened. This probably represents a subspecies or local race.

C. GUBERNATORIUM (Crosse). Pl. 36, figs. 31, 32, 33, 34.

Shell deeply but shortly rimate, *oval* or *tapering-oblong*, rather strong and solid; white, nearly uniform or with livid stains, or variegated with reddish-brown or gray brown irregular stripes; glossy, nearly smooth or with the last one or two whorls finely costulate. Spire rather slowly tapering, with convex outlines and an obtuse apex. *Aperture large, dark or pale brown within*, the peristome white or brown, narrowly reflexed and recurved, often much thickened on its face. Parietal lamella strong but short; columellar lamella small. Parietal callus varying from thin to strong.

Length 23, diam. 11, longest axis of aperture  $9\frac{1}{2}$  mill. (type).

Length  $26\frac{1}{2}$ , diam. 12, longest axis of aperture  $11\frac{1}{2}$  mill.

Length 19, diam. 10, longest axis of aperture 9 mill.

Bahamas: *New Providence* (Sir Rawson W. Rawson).

*Pupa gubernatoria* CROSSE, Journ. de Conchyl., 1869, p. 186; 1870, p. 105, pl. 2, f. 4 (lower figure).—PFR., Monogr., viii, p. 354.

Readily distinguished from other species of *New Providence* by the large brown aperture, tapering contour, and the smoothness of the upper portion, while the last whorl or two may be either smooth or finely costulate. Crosse's type (pl. 36, fig. 31) was white, but specimens richly variegated with brown are equally abundant in the series I have seen.

C. AGASSIZI Dall. Pl. 36, figs. 39, 40.

Shell shortly rimate, *cylindric-tapering*, the last whorl widest, *very thick and strong*. Surface smoothish or with weak, low riblets irregularly developed; the *last whorl sculptured with sharp, narrow, rather high riblets on its latter portion*. Whorls 10 to 11, nearly flat, the spire passing gradually into a long cone terminating in a very obtuse apex. Aperture irregularly ovate, the *peristome broadly expanded in a thin flange, in front of which it is built forward*, very thick, continued in a *strong, straight or arcuate raised ledge across the parietal wall*. Parietal lamella strong and long; axial lamella small.

Length 35, diam. 13 mill.

Length 31, diam.  $12\frac{1}{2}$  mill.

Bahamas: *New Providence*, fossil in calcareous sand-rock, at the W. quarry, top of Nassan Ridge (A. Agassiz).

C. (*Maynardia*) *agassizi* DALL, Bull. Mus. Comp. Zool., xxv, no. 9, p. 120, pl. —, figs. 9, 10.



This species, which has only been found fossil, is much heavier than *C. gubernatorium* or *C. eleutheræ*. The lip resembles that of the latter species, but is more strongly developed. It differs from both in the strong parietal ridge. *C. milleri* is like *C. agassizi* in the raised parietal ridge and rather long parietal tooth, but it has a different and finer sculpture.

There is a polymorphic recent species, varying from wholly costulate to quite smooth, having the strong parietal ledge of *C. agassizi*, in the collection of the Academy (no. 76877). The specimens were taken from among a lot of *C. glans* of unknown locality. The specimens are bluish or livid white, with the lip less developed than in *agassizi*. This race will probably be found to occur on some island or key between New Providence and Eleuthera.

*C. MILLERI* (Pfeiffer). Pl. 36, figs. 44-49.

Shell rimate, cylindric, terminating in an *acutely conic, rather long cone*; solid and strong; dull white, rarely flesh-tinted, with sparse, undulating, brownish-corneous streaks. Whorls  $10\frac{1}{2}$  to 12, nearly flat, the last well rounded below. Sculpture of *fine, low striæ on the last whorl*, or on its latter half, *the rest of the shell nearly smooth*. Aperture angularly ovate, white or slightly livid within; peristome narrowly reflexed, *very much thickened*, built forward; *parietal margin a straight, raised callous ridge*. Parietal lamella strong and moderately long; axial lamella inconspicuous.

Length 38, diam. 12-13 mill.

Length 31, diam. 13 mill.

Length 28, diam. 12 mill.

Bahamas: *Duck Key*, Exuma Group (W. W. Miller).

*Pupa milleri* PFR., Malak. Bl. xiv, 1867, p. 129; Novit. Conch., p. 365, pl. 84, f. 6-13; Monogr. vi, p. 289.—? *Helix pentodon* MENKE, Zeitschr. f. Malak., 1846, p. 128; PFR., Monogr. i, p. 185; Conchyl. Cab., *Helix*, p. 198, pl. 100, f. 32-34. Cf. v. MARTENS, Mal. Bl. vi, 1859, p. 209.

The very strong callous ledge across the parietal wall is characteristic. The parietal lamella is strong and rather long, as in *C. agassizi*.

The young shells of five whorls (fig. 47) have five small teeth. *Helix pentodon* Menke was based upon a very young *Cerion* at this stage, though probably not this species; a fact first pointed out by Prof. E. von Martens.

*C. PILLSBURYI* Pillsbry and Vanatta. Pl. 36, figs. 41, 42.

Shell tapering sub-cylindrical, the later three whorls of nearly equal diameter, those above forming a rather long cone, which passes very gradually into the sub-cylindrical portion; apex very obtuse. Whorls 10 to  $10\frac{1}{2}$ , the nepionic smooth, next whorl sharply finely striate or smoothish; succeeding whorls flat and smooth with some growth-lines only; last one-half to two whorls regularly costulate, riblets narrower than the intervals, about one millimeter apart. Base rounded, not compressed; umbilical chink very short, imperforate. White with irregular, interrupted, brown or gray-brown streaks.

Aperture vertical; parietal tooth very small, weak and short; columellar fold distinct, extending inward one whorl. Peristome well reflexed, whitish, rather thin or thickened; parietal callus moderate or very thin.

Alt. 29, diam. of last whorl above aperture 11–12; longest axis of aperture  $11\frac{1}{2}$  mill.

Alt.  $27\frac{1}{2}$ , diam. of last whorl above aperture 11; longest axis of aperture 11 mill.

Bahamas: *Gun Cay*, on the western edge of the Andros bank. (Dr. Wm. H. Rush.)

*C. pillsburyi* P. & V., P. A. N. S., 1897, p. 366, f. 5.—PILSBRY, *Nautilus* xii, p. 26, 27, f. 5.—*Cerion pannosum* Mayn., DALL, Bull. Mus. Comp. Zool. xxv, no. 9, p. 119. Not of Maynard.

The rather long and gradually tapering cone, smooth surface above, the last one or two whorls ribbed, and the very small parietal tooth, are the most prominent features of this species. It is closely related to *C. gubernatorium* and *C. eleutheræ*, both of which have the parietal tooth decidedly larger and the interior darker. Its superficial resemblance to *C. regina eucosmium* is remarkable; but the small area behind the columellar lip, with short umbilical chink and rounded base, distinguishes it at once from that form. It is superficially not unlike some of the Cayman Is. species, but has not the strong and long parietal tooth of those forms. This species is named in honor of Lieutenant-Commander John Elliott Pillsbury, of the U. S. Coast Survey Steamer "Blake."

*C. NITELOIDES* Dall. Pl. 36, fig. 43.

Shell compact, solid, grayish white, with a livid brownish lining; ten whorls of which two and a half are nepionic and smooth, the re-

mainder polished and for the most part faintly sculptured with little raised transverse lines, often obsolete; on the last half of the last whorl these lines are coarser, irregular and more prominent; the aperture is rounded except where the peristome crosses the body, with a slightly beveled reflected edge; the parietal tooth is nearly central, short and low, the pillar-tooth also low, is situated about the middle of the pillar and makes a little less than a complete turn around the axis of the shell. Height of the shell 28; maximum diameter 12 mill. (*Dall*).

*Water Cay, Salt Cay Bank*, on the north side of Cuba near the western end of the Bahama banks. Types in the Iowa State University and National Museums.

*Cerion (Maynardia) niteloides* DALL, Bull. Lab. Nat. Hist. Iowa State University, iv, no. 1, p. 15, pl. 1, f. 2 (1896).

"This species externally much resembles *Cerion (Maynardia) nitela* Maynard, which is a species native to the west end of Little Cayman island in the Caribbean Sea on the south side of Cuba. As the species of *Cerion* are very limited in their distribution, the wide separation of the two localities raises a suspicion of distinctness, notwithstanding their superficial likeness, and this suspicion is measurably confirmed by the following differences: *C. nitela* has a larger axis and a considerably larger and perforate umbilicus; its parietal tooth is more elevated and less elongated, the pillar tooth slightly more elevated, and its inward prolongation decidedly more feeble; lastly its aperture is narrower, more horse-shoe shaped and less rotund than in *C. niteloides*. The apex is decidedly more pointed in the specimens of *C. nitela* before me as well as in Maynard's figures, but this character is variable in some of the species." (*Dall*.)

#### X. Group of *C. album*.

Robust, strongly ribbed species, closely allied to the group of *C. gubernatorium*, but ribbed to the apical whorl (except *C. lentiginosum*). Parietal callus appressed, thin at the outer edge.

The species are from Abaco and Rum Key; islands not lying on the same bank, but with very similar snails of this genus.

These species are unlike most of those of the *C. glans* group in wanting a raised ledge across the parietal margin; but they are not greatly different.

## a. Species from Abaco.

b. White; ribs regularly strong and close; umbilical area small. *C. abacoense*, p. 246.

b'. White or mottled above; ribs wider apart or irregularly spaced; umbilical area larger. *C. maynardi*, p. 246.

## a'. Species from Rum Key.

b. Entire shell ribbed. *C. album*, p. 247.

b'. Whorls of the cone smooth. *C. lentiginosum*, p. 248.

*C. ABACOENSE* Pilsbry and Vanatta. Pl. 37, figs. 58, 59.

Shell cylindrical, solid and strong, entirely white. Latter three whorls of about equal diameter, preceding one slightly smaller, those earlier rapidly tapering to form a short cone; apex obtuse. Sculptured with *very regular, rather close*, strong and nearly straight riblets, as wide as, or narrower than the interstices, numerous (31–38 on last whorl); part of the riblets generally splitting on the base;  $1\frac{1}{2}$  to  $1\frac{3}{4}$  nepionic whorls free from riblets, and those of the following several whorls very fine, though distinct. Whorls  $9\frac{3}{4}$  to  $11\frac{1}{2}$ , slightly convex, the last ascending as usual. Sutures well-marked. Umbilicus a nearly straight suture terminating in an almost closed axial chink; umbilical area (back of columellar lip) small, with a bounding furrow below.

Aperture vertical, brought forward almost to anterior level of the cylinder; rounded, nearly as wide as high, obliquely truncate above. Peristome well reflexed, recurved, its face thickened and convex; parietal callus heavy, but thin at its outer edge. Axial fold moderate, parietal fold deep seated, low, and rather long.

Length 34, diam. 13; alt. of aperture 12 mill. (largest specimen).

Length  $27\frac{1}{2}$ , diam. 13; alt. of aperture  $11\frac{3}{4}$  mill. (shortest specimen).

Bahamas: *Abaco*.

*C. abacoense* P. and V., Proc. A. N. S. P., 1895, p. 209; 1896, p. 332, pl. 11, f. 11.—? *Strophia mumia* var.? W. G. BINNEY, Ann. Lyc. Nat. Hist. of N. Y., x, p. 348; Ann. N. Y. Acad. Sci., iii, p. 101, pl. 7, f. B (dentition).

Resembles *C. album* Mayn. of Rum Key, but has a much smaller umbilical area and a thicker lip. It is closely related to *C. maynardi*.

*C. MAYNARDI* Pilsbry and Vanatta. Pl. 37, figs. 64, 65.

Shell large, strong, cylindrical, white or fleshy in the intervals

between strong, slightly curved ribs, separated by two or three times their width or sometimes irregularly and widely spaced on the cylindrical portion, which consists of 3 to 4 whorls; those above forming a short cone on which the ribs are much closer. Whorls  $11\frac{1}{2}$ , flat, the last ascending, somewhat tapering downward, but with well rounded base, upon which the ribs are obsolete, but replaced by wrinkles or fine costulae. Umbilical rima very deep, curved, the area below it wide, usually bounded by a spiral groove well within the basal margin of umbilical tract. Aperture ovate-truncate, brown in the throat; parietal lamella very strong, often calloused on the left side; rather short; axial lamella small, one whorl long. Peristome stout, white, broadly reflexed, its face convexly thickened but not "duplicate;" broadly vaulted over the open and dilated umbilical area; parietal callus varying from thin to heavy, but always thin at the edge.

Length 35, diam. 13 mill.

Length  $34\frac{1}{2}$ , diam.  $14\frac{1}{2}$  mill.

Length  $34\frac{1}{2}$ , diam.  $15\frac{1}{2}$ .

Bahamas: *Abaco* (R. Swift).

*C. (Maynardia) maynardi* P. and V., Proc. A. N. S. P. 1895, p. 210; 1896, p. 323, pl. 11, f. 31.

This form differs from *C. abacoense* in the coarser, more widely spaced ribs, deeper umbilical chink and larger umbilical area.

A series of 30 specimens (No. 73628), received without locality, consists of smaller shells than the type lot, sparsely marked with small stripes and transverse spots of brown or gray in the intervals between the ribs, at least on the upper whorls. Specimens measure: Length  $31\frac{1}{2}$ , diam. 13 mill.; length 34, diam. 12; length  $26\frac{1}{2}$ , diam. 12 mill. There is thus a wide range of variation; and some of the shorter specimens approach *C. abacoense*, establishing a transition between the two species, which may have to be consolidated.

*C. ALBUM* (Maynard). Pl. 37, fig. 66.

Shell with a long and deep umbilical chink, large, solid, cylindrical and white. Whorls  $10\frac{1}{2}$ , nearly flat, the latter 3 or 4 of about equal diameter, those above forming a rather straight-sided cone, the apex obtuse; last whorl well rounded beneath. Sculpture of *close, regular, rather strong riblets, about as wide as the intervals, and extending to the first whorl*, which is smooth; the riblets becoming

smaller above, reduced to fine, sharp striæ on the earlier whorls. On the base of the last whorl the ribs become obsolete. Aperture truncate-ovate, brown in the throat; peristome white, reflexed, not much thickened; the columellar lip dilated, *a large umbilical area* behind it. Parietal lamella small, rather short; axial lamella small. Parietal callus thin.

Length 33.5, diam. 14 mill.

Length 35.4, diam. 13.7 mill. (type).

Length 28, diam. 12.5 mill.

Bahamas: *Rum Key*, on the west coast near the salt pond, on the low shrubbery between it and the beach (Maynard).

*Strophia alba* MAYN., Contrib. to Sci., i, No. 2, pp. 74, 75, f. 9, 10; pl. 7, f. 17 (July, 1889).

The umbilical area is larger and the peristome thinner than in *C. abacoense*. It differs from *C. lentiginosum* by having the riblets extending upon the cone.

Var. *BROWNEI* (Maynard). Pl. 37, figs. 62, 63.

Oval, white, robust and heavy, ribbed throughout except the first whorl, the ribs about as wide as the intervals, 20 on the last whorl. Aperture small, yellowish within; teeth small; parietal callus very prominent. Length of type,  $27\frac{1}{2}$ , diam.  $12\frac{1}{2}$  mill.; varying from 29 to  $22\frac{1}{2}$  mill. long.

Near the north side of *Rum Key*, among low shrubbery (Maynard).

*Strophia brownei* MAYN., Contrib. to Sci. i, no. 4, p. 196, pl. 16, f. 4 (probably issued early in 1891).

Smaller and thicker than typical *album*, with thicker peristome and parietal callus. The part of Mr. Maynard's work containing this species bears a false date, "January, 1889,"—three months earlier than the date of the first number of the same volume. It was received at this library on April 7, 1891.

*C. LENTIGINOSUM* (Maynard). Pl. 37, figs. 60, 61.

Shell with a rather long umbilical suture, large, solid, cylindrical; white, sometimes uniform or with a few gray spots, but typically mottled profusely with dull brown. Whorls 10, nearly flat, the latter 3 of about equal diameter; those above forming a nearly straight-sided cone, the apex obtuse. Sculpture of moderately strong *ribs separated by wider intervals, on the lower  $2\frac{1}{2}$  to 4 whorls, obsolete on*

the base, and wanting on the conic portion, which is marked with growth-striae only; portions of the second and third whorls minutely striate. Aperture truncate-ovate, brown in the throat; peristome reflexed, but slightly thickened, the ends connected by a thin or moderate parietal callus. Parietal lamella small, low and rather long. Axial lamella small.

Length 34, diam. 13 mill.

Length 29, diam.  $12\frac{1}{2}$  mill.

Bahamas: *Rum Key*, in the interior on the western side (Maynard).

*Strophia lentiginosa* MAYN., Contrib. to Sci. i, p. 75, f. 11, pl. 7, f. 18 (July, 1889).

This species differs from *C. album* in the smoothness of the whorls of the cone, only those of the cylindric portion of the shell being ribbed. The ribs are noticeably more separated than in *C. album*. It varies in coloring from white to conspicuously mottled. The mouth is less brown than in *C. eleutheræ*, which is a more slender species.

#### XI. Group of *C. glans*.

*Maynardia* DALL, Bull. M. C. Z., xxv, no. 9, p. 121, type *C. neglectum*.

Shell usually shortly rimate and copiously ribbed throughout, with 20–30 ribs on penult. whorl (rarely smooth); parietal lamella usually stout and short. The young shells are usually toothless except for a columellar lamella, but sometimes the Andros form of *C. glans* has five teeth. The parietal margin is generally raised in a straight ridge or ledge, but this fails in many individuals or races. Outer lip thin or reflexed, thickened and beveled.

Widely distributed in the northern-central islands of the Bahamas.

a. Ribs impressed below the suture, forming a subsutural series of low beads. *C. martinianum*.

a<sup>1</sup>. Ribs strong, acute and roughly cut. Turk's Island.

*C. blandi*.

a<sup>2</sup>. Without the above characters.

b. Large forms with narrow lip, from islets southeast of New Providence. *C. ritchiei*, p. 250; *C. eburneum*, p. 252.

b<sup>1</sup>. Forms of medium size from New Providence and Andros, with the immediately adjacent keys and islets, and Gun Cay.

*C. glans*, p. 253.

C. RITCHIEI (Maynard). Pl. 39, figs. 91, 92.

Shell large, rimate, cylindric, solid and strong; impure white with white ribs and brown or gray stains in many of the interstices, or all of the intervals may be purplish-brown. Sculpture of even, strong, nearly straight ribs, usually a little narrower than their intervals, 25 to 28 in number on the penultimate whorl. Whorls about  $11\frac{1}{2}$ , slightly convex. Aperture small, brown or dark gray within; peristome white, *very narrowly expanded*, the margins *connected by a strong, straight, raised ledge* across the parietal wall. Parietal lamella very stout, blunt and heavy, rather short. Axial lamella small.

Length 35, diam.  $13\frac{1}{2}$ , longest axis of aperture 12 mill.

Length 37, diam. 14, longest axis of aperture 12 mill.

Length  $34\frac{1}{4}$ , diam.  $14\frac{1}{4}$  mill. (type).

Bahamas: *Highborn Key*, the typical form found about the head of the bay on the south side, along the eastern hills northward for about a mile, and southward to the southern point of that portion of the key; westward it spreads to the front of the hills of that division of the key, but is not found on them (Maynard).

*Strophia ritchiei* MAYN., Contrib. to Sci. ii, p. 135, fig. 41.—*Strophia grayi* MAYN., t. c., p. 138, f. 42, 43.—*S. grayi gigantea* MAYN., t. c., p. 141, f. 44a.—*S. grayi pumilia* MAYN., t. c., p. 143, f. 44b (Dec., 1894).—*Cerion ritchiei vannostrandii* P. & V., Proc. A. N. S., Phila., 1896, p. 323, no. 35d.

This species is distinguished by its large size, the very slightly expanded or unexpanded lip, prominent parietal callus and stout parietal tooth. Mr. Maynard describes several forms, which are, however, only selected specimens. Form no. 1, with the size and shape of the type, has about 25 ribs on the last whorl; the type shell having 23. The color is darker within and between the ribs (pl. 39, fig. 92). Form no. 2 is smaller,  $27\frac{1}{2} \times 11\frac{3}{4}$  mill., with 10 whorls and 16 ribs on the last. Form no. 3 is cylindric, with 11 whorls, with fewer ribs, the number sometimes as low as 18 on the last whorl. It forms a transition to *grayi*. Form no. 4 has the contour of the type, but the aperture is wider, more open, and the ribs more numerous, 34 on the last whorl. There are numerous intermediate examples.

Form *grayi* (Maynard). Pl. 39, figs. 93, 94, 98, 99.

Usually perforate, white, uniform or stained with blue at the base and in some of the intercostal spaces, cylindric, solid and strong.



Strongly ribbed, with 17 to 26 ribs on the penultimate whorl. Aperture small, dark within; *peristome hardly expanded, the margins thin, built forward*, becoming free in front, rugose outside. Teeth as in *C. ritchiei*.

Length 27, diam.  $11\frac{1}{2}$ , longest axis of aperture  $9\frac{1}{2}$  mill. (form No. 2).

Length 33, diam. 15, longest axis of aperture  $10\frac{1}{2}$  mill. (typical form).

Length  $29\frac{1}{2}$ , diam.  $14\frac{1}{2}$ , longest axis of aperture 10 mill. (form No. 1).

*Highborn Key*, on a steep conical hill at the northern end of the key, terminating the range of hills along the eastern side, chiefly on stems of white-barked wild fig trees.

Distinguished chiefly by the thin margins of the peristome, which is more or less built forward, beyond the ventral outline of the shell. The typical form (pl. 39, figs. 93, 94) measures from 26 to 35 mill. long (type specimen  $31\frac{1}{4} \times 13\frac{3}{4}$  mill.), and is found abundantly at the place mentioned above. At the base of the same hill on its western side a shorter, wider form occurs (fig. 95), which Mr. Maynard calls form No. 1. Form No. 2 (fig. 96) is smaller, with less produced peristome. It occurs on the flats near the northern bay of the key. Form No. 3 is short, thick and cylindrical, and occurred near the ruins of the house on top of a hill midway of the eastern arm of the key, adjoining the range of typical *C. ritchiei*.

Form *giganteum* (Maynard) is very large, white or copiously stained with dull reddish-brown in the intervals. The size varies from  $41\frac{3}{4} \times 15$  to  $33 \times 13\frac{1}{2}$  mill. The white form lives in the thickets growing along the hillside to the south of the ruined house mentioned above; the mottled form (pl. 39, fig. 1) is found in a little valley on the hillside near the landing, near the head of the southern bay. It is rather absurd to distinguish this form from typical *ritchiei*, which occurs in the same area.

Form *pumilum* (Maynard). Quite small, with  $9-9\frac{1}{2}$  whorls, white, bearing separated ribs, about 18 on the penult whorl. Peristome thin or somewhat thickened, not produced forward above. Length 23-24, diam. 11 mill. (fig. 97). About 50 specimens were found by Mr. Maynard clinging to the stems of two or three small trees, growing just south of a deep gorge making in from the sea, about midway of the western border of the key.

Subsp. *VANNOSTRANDI* Pilsbry and Vanatta. Pl. 39, fig. 2.

Large, solid and white; *smooth* except for some irregular folds on the latter portion of the last whorl. Whorls nearly 12. Aperture small, dark brown within, the peristome not expanded, built forward and rugose outside; teeth very strong. Length  $40\frac{1}{2}$ , diam.  $15\frac{1}{2}$ , longest axis of aperture 13 mill. Habitat unknown.

The only smooth member of the *C. glans* group known.

*C. EBURNEUM* (Maynard). Pl. 39, fig. 3.

Shell with a compressed umbilical chink, cylindric, solid, white; regularly and rather closely ribbed throughout, the ribs as wide as their intervals, about 29 on the penultimate whorl. Whorls 10– $10\frac{1}{2}$ , but slightly convex, the last with a straight umbilical chink and moderately wide umbilical area. Aperture angularly ovate, brown inside; peristome very narrowly recurved, its face thickened, the margins connected by a strong straight parietal ledge. Parietal lamella strong, more or less duplicate, or buttressed on the left side; axial lamella small but distinct, a low accessory tubercle sometimes appearing above it.

Length  $32\frac{1}{2}$ , diam. 12 mill.

Length  $28\frac{3}{4}$ , diam.  $11\frac{1}{4}$  mill. (type).

Length 25, diam.  $11\frac{1}{4}$  mill.

Bahamas: *U Key*, one of the Allen's Harbor group, north of Highborn Key, on the low, sandy southern portion (Maynard).

*Strophia eburnia* MAYN., Contrib. to Science, ii, p. 144, f. 45 (December, 1894).—*S. elongata* MAYN., t. c., p. 148, f. 46.

This form is closely related to *C. ritchiei* of Highborn Key. It is somewhat more slender and more closely ribbed, with the lip somewhat thicker.

*U Key* is a small key north of Highborn Key, shaped like the letter U, about a quarter of a mile long, and nowhere over a hundred yards from shore to shore. Upon the southern end of this key, among scattered palms, Mr. Maynard found hundreds of dead, bleached shells of this species. On the little hill on the eastern border of the low, sandy tract, twelve living specimens were collected from some low bushes. The form is evidently almost extinct, its area having been invaded by wind-blown sand, according to Mr. Maynard.

Form *elongatum* (Maynard). Pl. 39, figs. 4, 5.

Somewhat more tapering above, with slightly more numerous riblets, 33 on the last whorl; parietal tooth very large, prominent and double. Length of type  $33\frac{1}{4}$ , diam.  $12\frac{1}{2}$  mill. Varies from  $36\frac{1}{4} \times 13$  to  $30\frac{3}{4} \times 11\frac{1}{4}$  mill. Dead specimens only were found on a little key about a mile north of U Key, at Allen's Harbor.

C. GLANS (Küster). Plates 40, 41, 42, 43.

Shell cylindric or long ovate, white, blue-white or cream-white, uniform or mottled or striped with brown, ochre or purple-brown; often dull and lustreless; ribbed more or less strongly, usually with 20 to 30 ribs on the penultimate whorl. Aperture irregularly ovate, brown or ochraceous within, the lip expanded or reflexed, usually thickened; parietal callus generally thick, often raised, forming a straight ridge or ledge.

Bahamas: *New Providence and Andros with the immediately adjacent keys and islets; Gun Cay.*

*Pupa glans* KÜSTER, Conchyl. Cab., p. 74, pl. 11, f. 1, 2 (1848 or earlier).—PFR., Monogr., ii, p. 316; viii, p. 355.—SOWERBY, C. Icon., pl. 1, f. 2a.

*Pupa varia* BONNET, Revue et Magazin de Zoologie (Sér. 2), xvi, p. 71, pl. 6, f. 3a, 3b, 4 (1864).—PFR., Monogr., vi, p. 291.—*C. glans varium* Bonnet, PILS. AND VAN., Proc. A. N. S. P. 1896, p. 324.—? *Pupa zebra* Weinland, SOWERBY, Conch. Icon., xix, pl. 2, f. 12a, 12b (May, 1875).—*Strophia curtissii* MAYNARD, Contributions to Science, ii, No. 3, p. 107, f. 33 (December, 1894).—*S. curtissi nivea* MAYNARD, t. c., p. 112, f. 34A (on p. 117).—*Strophia thorndikei* MAYNARD, t. c., p. 116, f. 34B,C,D.—*Strophia cinerea* MAYNARD, t. c., p. 119, f. 35.—*Strophia cinerea robusta* MAYNARD, t. c., p. 121, f. 36.—*Strophia cinerea tracta* MAYNARD, t. c., p. 123, f. 37A.—*Strophia cinerea mutata* MAYNARD, t. c., p. 125, f. 37B.—*Strophia alba* MAYNARD, t. c., p. 128, f. 38.

*Strophia coryi* MAYN., t. c., p. 129, f. 30.—*S. neglecta* MAYN., t. c., p. 150, f. 47.—*S. neglecta agara* MAYN., t. c., p. 152, f. 48.—*S. carlotta* MAYN., t. c., no. 4, p. 154, f. 49 (Dec., 1894).

*S. glans* Kuester, MAYNARD, t. c., p. 156, f. 50.—*S. glans grisea* MAYN., t. c., p. 159, f. 51.—*S. regula* MAYN., t. c., p. 161, f. 52.—*S. bimarginata* MAYN., t. c., p. 164, f. 53.—*S. b. cera* MAYN., t. c., p. 168, f. 54.—*S. pilsbryi* MAYN., t. c., p. 170, f. 55.—*S. p. evolea*

MAYN., t. c., p. 173, f. 57.—*S. restricta* MAYN., t. c., p. 175, f. 58.  
—*S. crassicostata* MAYNARD, unpublished.

*Cerion cinereum* Mayn., DALL, Bull. Mus. Comp. Zool., xxv, no. 9, p. 119 (Nassau, Gun Cay, Great Ragged Cay).—? *C. glans* Küster, Dall, t. c., p. 117 (Watling Island).—*C. glans* Küst., PILSBRY, Nautilus, xii, p. 26 (Gun Cay).—? *Cerion neglectum* Mayn., DALL, t. c., p. 120 (Great Stirrup Cay).

This is a widely distributed species extending from New Providence and Andros westward to islets on the western edge of the Great Bahama Bank. South of New Providence it has been modified into larger forms which may be allowed specific rank.

As usual in *Cerion*, every "colony" has its own characteristics of coloring and form, and its own cycle of variations. In the mass or average of specimens from a single spot, these local peculiarities are often quite perceptible, sometimes striking; but the variations among individuals of any colony fully cover the differences between colonies, so that if we conventionally represent the single colony by a circle, the periphery of which stands for the extremes of variation, then the series of colonies could be represented by a series of such circles overlapping in various degrees, sometimes forming chains, sometimes complexly interlaced groups. Where one has a large series from any one point, it is easy to see that the variations within a single "family" are frequently greater than the differences between several such colonies.

It is this complete intergradation between colonies, even if shown by but a small percentage of individuals, which causes me to reject as species the forms defined by Mr. Maynard. That these local forms exist, distinguishable in the majority or average of specimens, has been established by Maynard, beyond controversy; but they are not "species." They are "physiological varieties," which owe their characteristics to the immediate action of the environment, and respond to any changes therein. There is every reason to believe that some of Mr. Maynard's "species" may be produced in one generation by changing the food plant from a woody shrub growing in a sterile place, to succulent herbage in a more favorable soil, just as a plant growing on a hard roadside will be stunted, bear few and comparatively simple leaves and a single flower, perhaps, while in the cultivated field hard by it will attain greater size, different shaped leaves, profuse inflorescence, etc. That *C. glans* varies con-

*spicuously with locality and station is proven. That zoological knowledge is increased by naming the individual colonies from every sisal field and potato patch in the Bahamas, is open to question. The importance of studying and recording the local variations is another matter. The study of the variation of a species is hampered rather than helped by a load of names, which exactly fit only the series of shells obtained by the namer.*

The forms of *C. glaus* fall into several general groups, the differential features of which are transgressed by comparatively few specimens. These groups may conveniently be termed sub-species.

*a.* Outer lip reflexed, thickened on the face, generally more or less beveled.

*b.* Parietal callus appressed, not raised to form a ridge :

typical *glams*.

*b*<sup>1</sup>. Parietal callus raised in a straight ridge or ledge.

*c.* New Providence forms : sub-species *coryi*.

*c*<sup>1</sup>. Andros forms, often bluish-white : subsp. *griseum*.

*a*<sup>1</sup>. Outer lip but little or not expanded, thin ; riblets usually narrower : subsp. *varium*.

The species from Highborn and other keys south of New Providence are related to the *varium* type.

#### *Forms from New Providence.*

Subsp. *VARIUM* (Bonnet). Pl. 40, figs. 5-11.

Shell rather shortly rimate, cylindric, the *terminal cone* rather long and gradually tapering. White or cream-white, very *irregularly striped and maculate with dark brown, and usually with some ochre or yellowish-brown streaks or patches*. Sculpture of close, *fine riblets* throughout, usually a little narrower than the intervals, and about 25 to 30 in number on the penultimate whorl, the greater number typical. Whorls 10 to 12, nearly flat. Aperture angularly ovate, *usually dark brown or dull lead-color within* ; peristome whitish, *very narrowly* expanded, the margins connected by an *almost straight, raised ledge* or cord across the parietal wall. Parietal lamella strong, short ; axial lamella minute.

Length 25, diam. 10 mill. (Bonnet's type).

Length 22, diam. 10 mill.

Length 20½, diam. 8½ mill.

Bahamas : *New Providence at Nassau* (Swift, J. J. White and others).

The prominent features of this sub-species are its fine riblets, very narrowly expanded or subreflexed lip, dark interior, mottled coloring and the raised ridge across the parietal wall. A large series of specimens agreeing exactly with Bonnet's description and figures is before me. A long and a short example, collected last year at Nassau by Mr. J. J. White, are figured, pl. 40, figs. 8, 9. Typically the color stripes or spots run over both ribs and intervals, but occasionally the riblets are all white, as in a series collected by Mr. Bendall on New Providence, pl. 40, figs. 10, 11. Bonnet's original figures are copied on pl. 40, figs. 5, 6, 7.

Form *curtissii* Maynard (pl. 40, fig. 12) is rather pale with sparser dark maculation, looking a little bleached beside the typical *varium*. Tawny or ochre patches replace part of the white. The aperture is typical, but riblets often more spaced, 21 to 25 on the penult. whorl. The type .98 x .40 inch, is almost exactly the size of the type of *varium*; but smaller specimens are common. The young have only a columellar lamella. Type locality is the north side of the cemetery between Waterloo pond and Nassau. It occurs also outside the cemetery wall to the west, and near the western border of the pond mentioned. In Maynard's "form no. 1" (pl. 40, fig. 13) the dark markings are faint or disappear, the lip is perceptibly thicker, and the riblets more numerous. It "is inclined to occur to the westward of the type location." "Form no. 2" (pl. 40, fig. 14) is elongate with 11 whorls, 21-27 riblets on the penult., lip rather thick, color typical. Occurs to the southward of type locality. "Form no. 3" is like the preceding, but with thinner lip. Occurs southward and eastward of type locality. "Form no. 4" is the size of the type, but the riblets are reduced irregular growth-lines except behind the lip, blotches large and dark. Five were found "among some banyan trees that stand on the top of a little hill in the cemetery, near an old ruin." "Form no. 5" is similar to the type in form and color, a little smaller, and the peristome is built forward and very thin. The parietal lamella is larger, three times as long as high, in most specimens. Spotter's Key, an islet in Nassau Harbor, lying about a third of a mile from the cemetery. Form *nivea* Maynard (pl. 40, fig. 15) varies from pure white to the ordinary color of *curtissii*. It is rather thin, and the parietal lamella often smaller than in *curtissii*. It occurs clinging to the trunk and limbs of the banyan tree near the old ruin in the cemetery mentioned above.

In form *thorndikei* Maynard (pl. 40, figs. 16 to 19) the size is reduced, the cone usually long, and the color faded, sometimes even white, the dark blotches being much reduced in size, number and intensity, and chiefly confined to the interstices. The riblets are white, and there is but little or none of the rich tawny color which adorns the type form. Length about 18, diam. 8 mill., riblets 23-26 on penult. whorl. This form occurred on the east side (chiefly) of a path across the cemetery mentioned above, about midway between the gate and a hill in the cemetery. *Thorndikei* is merely a small or somewhat dwarfed form of *curtissii*. It occupies an area of about 100 square yards, surrounded on all sides by that of *curtissii*. Among the larger shells there are some very small, length 14-15, diam.  $7\frac{1}{2}$ -8 mill., with  $7\frac{1}{2}$  whorls (fig. 19).

Form *cinereum* Maynard (pl. 40, fig. 20; pl. 41, figs. 21, 22, 23). Shape varying from that of ordinary *varium* to somewhat stouter. Riblets often stronger, about 25 on the penult. whorl. Whorls  $9\frac{1}{2}$  to 10. Aperture dull brown inside, the peristome narrowly or hardly expanded, scarcely or but little thickened. Riblets white or pale, the intervals various shades of brown, or largely invaded by white tracts. Length 29, diam. 11 mill., or somewhat smaller, length 26, diam.  $10\frac{1}{2}$  mill., down to  $23 \times 9\frac{1}{2}$  mill.

Hog Island, Nassau Harbor, along the shore of Middle Bay.

Some specimens, Mr. Maynard's "form no. 2" (fig. 24) are heavily mottled with black-brown and ochre, the ribs still mainly white. These occur east of the type locality, adjoining it. Larger, heavier shells than the type but similarly colored, occur northward (fig. 22). On the north side of Hog Island, among some dwarf palms growing directly back of the beach ridge, a stouter form, *robusta* Maynard, with 9 whorls, length 28, diam.  $13\frac{3}{4}$  mill. occurs. I can see no difference deserving a name in the specimens. In a restricted area on the borders of a field nearly on the eastern point of Hog Island the form called *tracta* by Maynard occurs (pl. 41, figs. 25, 26, 27). The interstices are chiefly dark, ribs white. Size varying from 19 to 28 mill. long. Many of them are absolutely indistinguishable from Maynard's "form no. 2" of *cinerea*.

On shrubs along the rocky northern shore of the western half of Long Key (about a mile east of Hog Island), a form called *S. cinerea mutata* Mayn. occurs. It resembles *cinerea* of Hog Island in everything but distribution (pl. 41, figs. 28, 29, 30), the last figure representing Maynard's "form no. 1."

Form *albea* Mayn. (pl. 41, fig. 31). On the south side of Spruce Key, a barren little islet north of Long Key, a few specimens, mostly dead, of "*Strophia albea*" Maynard occurred. They are rather dark flesh-colored outside and within, or brown inside; uniform, or with the ribs a little paler. A specimen measures, length  $23\frac{1}{2}$ , diam. 10 mill.; ribs on penult. whorl 24. It seems nearly extinct, as only three living ones were found.

A peculiar form allied to *varium*, *ritchiei* and *eburneum* is illustrated on pl. 44, figs. 78, 79, 80. It is pillar-like, some specimens very large and long, with as many as  $12\frac{1}{2}$  whorls, others (fig. 79) are much smaller. The lip is not expanded, aperture small with the margins built forward. The locality is unknown, but as the specimens occurred with *Pleurodonte provisoria*, *Cepolis varians*, the New Providence form of *Oxystyla undata*, and some marine shells, it is likely that they are from New Providence.

Subsp. CORYI Maynard. Pl. 41, figs. 32-36.

The oblong-cylindric shell is solid, strongly ribbed, intervals brown, in places black-brown, the ribs chiefly white, about 20 on the penult. whorl. Aperture brown within, the *peristome reflexed and recurved, thickened on the face* (fig. 34); parietal callus heavy and thick, but typically *not* elevated in a straight ledge. Parietal lamella strong and usually rather *long*; axial lamella small but distinct. Length 25, diam. 10-11 mill. There is also a short form, length 21, diam.  $9\frac{1}{2}$ -10 mill. This variety occurs on the extreme west end of New Providence, on the bushes and herbage growing along the bay. Five specimens, undoubtedly *coryi*, were taken by Mr. Maynard on Spruce Key, off Nassau, the type locality of "*S. albea*."

Mr. Maynard's *coryi*, "form no. 5" (pl. 41, figs. 35, 36), is very small,  $17\frac{1}{2}\times 8$  to  $20\times 9$  mill., has a distinct ledge or ridge across the parietal wall, the outer lip is *not reflexed or thickened*, and there are about 25 riblets on the penult. whorl. Parietal lamella small. It is very similar to "*thorndikei*" and *exactly* like some specimens of "*cinerea*, form no. 1," of Maynard. According to Mr. Maynard, there are many individuals of intermediate characters connecting this form to *coryi*.

Form *neglectum* Maynard (pl. 42; fig. 37). Whitish or gray-white, sometimes blue-tinted in the interstices, and usually obscurely showing a few dark blotches. Ribs *irregularly and widely spaced*.



Aperture brown inside, the outer lip reflexed, often thickened on the face; parietal callus ridge-like; parietal lamella small and short. Length 22, diam. 10 mill., but varying from 26 to 19 mill. long. Mr. Maynard collected the types in 1884 on the borders of a deserted plantation about a mile west of Fort Charlotte, N. P. One of these is figured, pl. 42, fig. 37. Nine years later he revisited the spot, finding the plantation cultivated, the bushes uprooted to make place for sisal fields. The shells occurring on the Agave plants in this place were chiefly intermediates between "*neglectum*" and the alleged subspecies "*S. n. agava*." This form *agava* (pl. 42, fig. 38, one of the type lot, and figs. 39 to 44), which is one of the most abundant in the collections I have seen, is typically larger than "*neglectum*," dirty brownish- or ashen-white, copiously or sparsely maculate or suffused with purplish- or bluish-brown; lusterless; the ribs are nearly regular, usually about 23 (rarely as many as 29) on the penult. whorl. The outer lip is reflexed in a thick flange, and the parietal callus forms a strong raised and straightened ledge. Interior brown, the parietal lamella generally rather short, occasionally elongated. It is common throughout the sisal fields west of Nassau. Mr. Maynard traced it about eight miles west and a mile inland.

A specimen of the *agava* type in the collection of the Academy was received from Dr. Pfeiffer as *glans*, and bears his autograph label.

In the immediate vicinity of Fort Charlotte, near Nassau, the form called *S. carlotta* Maynard (pl. 42, figs. 45, 46, 47) occurs. "The type locality is at the foot of the hill on which the fort stands, on the north side." The shell is stout in figure, ovate or oblong-cylindric, dull, pale brownish-white with indistinct darker markings. The ribs are rather narrow, lip reflexed and more or less thickened, parietal callus strongly or moderately developed. To the westward of the type locality somewhat larger and heavier shells occur (fig. 47), and up the hill, almost under the shadow of the old Spanish fort, a dwarf form (fig. 46) is found, its small stature probably due to the extreme dryness of the place, as Maynard remarks. "*S. carlotta*" if thrown among a handful of the ordinary "*agava*" form, could not be distinguished from them, because there are *no differences whatever* between many specimens. "*Carlotta*" is merely a name for "*agava*" from Fort Charlotte.

Typical *C. GLANS* (Küster). Pl. 42, figs. 48, 49, 50, 51, 52.

"Shell rimate, ovate, rather acute, rose-white, strongly ribbed, the ribs close, white. Whorls 10, a little convex, narrow, the last banded below with brown. Aperture semi-ovate, glossy and pale yellow within; peristome recurved, thickened, the parietal margin with one fold.

"Shell with an arcuate umbilical chink ending in a perforation, short and stumpy, broad ovate, rapidly tapering above, thin, almost lusterless, rose-reddish-white, obliquely ribbed except the first two whorls, the ribs strong, acute, crowded and somewhat arcuate. The 10 whorls are very narrow, flat-convex, appearing somewhat separated by an impressed suture; the last forms more than a third of the entire length, and shows towards the base a brown-reddish band surrounding the umbilical region, its lower edge washed out. The suture is irregularly crenate by the projecting ribs. Aperture obliquely half-ovate, glossy and pale yellow inside; peristome thick, lipped, reflexed outwardly, the margins connected by a callus. Columella short, rather straight, on the parietal wall a small fold stands, and a quite indistinct one may be seen far within on the upper part of the columella. Length  $8\frac{1}{2}$ –10, width 4–5 lines" (Küster).

*New Providence*, near Nassau (J. J. White).

Küster's description is given above, and his figures are copied on pl. 42, figs. 51, 52. The habitat of the species was unknown, but from the exact agreement with description and figures of specimens collected by Mr. J. J. White at Nassau, New Providence, there can be no reasonable doubt that that is the type locality. These shells (pl. 42, figs. 48, 49, 50) are *flesh-tinted* in the intervals between whitish riblets, which are narrower than the spaces and very numerous; the rather narrowly reflexed lip is thick; *the aperture is pale brownish-yellow or ochre-tinted within*. The parietal callus is thick and heavy, *appressed and gradually thinner towards its outer margin, not forming an elevated ridge* across the parietal wall, as in the ordinary "*glans*" of collections. Whorls  $9\frac{1}{2}$  to  $10\frac{1}{2}$ . It is often more elongate than Küster's types, specimens measuring:

Alt. 25, diam. 12 mill.; riblets on penult. whorl 25.

Alt.  $26\frac{1}{2}$ , diam. 12 mill.; riblets on penult. whorl 31.

Alt. 29, diam.  $12\frac{1}{3}$  mill.; riblets on penult. whorl 35.

Alt. 31, diam.  $11\frac{1}{2}$  mill.; riblets on penult. whorl 29.

Some specimens have coarser ribs than the majority of the lot;

others show some obscure bluish stains, besides the usual basal girdle, which may be either distinct or wanting in this and the allied species. Küster's figure shows about 28 ribs on the penultimate whorl. Pfeiffer gives alt. 24, diam. 10, apert. 9 mill. long, 8 wide above as the dimensions, Küster's types being apparently the only specimens then known to him.

*Forms from Andros* (Subsp. *GRISEUM* Mayn.).

A knowledge of the Cerions of Andros we owe to Mr. C. J. Maynard, who explored various keys and mainland localities in the neighborhood of Middle Bight, on the eastern side. In general the blue-white color differentiates them from New Providence forms, but in many colonies mottled specimens occur, indistinguishable from some of the New Providence shells.

Form *griseum* Mayn. (pl. 43, figs. 57, 58). Intervals in part dull purple-fleshy or purplish-brown, the ribs white, base violet or flesh-colored in front. Ribs numerous, 27-28 on penult. whorl. Aperture brown inside, the lip reflexed and recurved, built far forward of the reflection, beveled (fig. 57). Parietal callus a strong, narrow ridge; parietal tooth stout. Length 25-26, diam.  $11\frac{1}{2}$ -11 mill. Fields north of Fresh Creek, about a mile from the settlement, along the road to Calabash Bay; also south of the creek, where it "completely intergrades" with the following. In fields directly south of the little settlement on Fresh Creek, but on the opposite side of the creek, is found the form called *S. glans* by Maynard (not *glans* Küster). It is white or bluish-white, often with some livid stains; rather short; 26-28 riblets on penult. whorl; interior dark, dull brown. The peristome has a more or less developed flange. Length 22, diam. 10.8 mill. Sometimes it is smaller,  $20\frac{1}{2}$ x9 mill., with the lip but little thickened, and sometimes larger,  $28\frac{1}{2}$ x11 mill., with fewer riblets, 23 on the penult. whorl (pl. 43, fig. 53; "form no. 2," fig. 54; "form no. 3," figs. 55, 56. Some shells are copiously mottled, and the larger examples of this form and of *griseum* can be exactly matched among New Providence specimens of the "*agava*" form.

Form *regulum* Maynard (pl. 43, fig. 59) is very large,  $37\frac{1}{2}$ x15 mill., or sometimes as short as 29 mill.; the ribs are very numerous and regular, 34 on the penult. whorl; blue-stained white, the interior dark brown, parietal ridge strong. Only shells inhabited by

hermit crabs were found along Fresh Creek near the settlement. One of these mutilated specimens is figured.

Form *bimarginatum* Mayn. (pl. 43, figs. 60, 61, 62) is white, bluish or gray-white, with brown aperture. Ribs 23-26 on penult. whorl. The parietal ridge is usually well elevated, and the outer lip is doubled, a thin lamina rising a short distance behind the edge (fig. 60). This is quite unlike the heavy flange of *C. glans griseum*, when typically developed, but varies a great deal, and in some specimens the lip is identical in structure with small specimens of *griseum*. The parietal tooth is strongly developed and often indistinctly doubled by a callous buttress or accessory tooth on the left side of the principal one. The young have five teeth, unlike New Providence forms, in which only the columellar lamella is developed in young shells. This form is found on Green Key, off Andros (figs. 60, 62), and Little Galden Key, Middle Bight, Andros (fig. 61). Several forms are distinguished by Maynard. No. 1 (pl. 43, fig. 61) occurs in the thicket away from the beach, on both keys, is larger with "an inclination to assume a beveled margin and single tooth, with a darker interior;" ribs 20-27 on penult. whorl. Form No. 2 (fig. 62) is quite small, bluish, sometimes mottled, the parietal tooth is simple and the lip merely expanded and a little thickened, like the small form of *griseum*. It occurs among grass on the rocks at Green Key.

Nine specimens obtained on trees and bushes on Green Key are thinner than *bimarginatum*, externally and internally of a "beautiful waxy white," the peristome thin, simply expanded a little, not double. Mr. Maynard has given these individuals the name *S. bimarginata cera* (pl. 43, fig. 63).

The form called *S. pilsbryi* by Maynard (pl. 43, fig. 64), occurs on an islet called Goat Key, about one-eighth of a mile long and nowhere over fifty yards wide, situated about a half mile directly west of Little Galden Key, Middle Bight, Andros. The shell is blue-white, often having a dark basal streak, and more or less indistinct dark marking on the cone. The lip is white, narrowly reflexed and more or less thickened. The interior is white, suddenly becoming dark in the throat. Parietal lamella stout. Length 21-27 mill. The typical form occurs on the eastern half of the key. On the western half the shells are yellowish or ivory-white, copiously mottled with dull brown and purple-brown, somewhat larger, the interior dark brownish throughout. The parietal lamella approaches the

parietal ridge, even reaching it in some individuals. Length 22-29 mill. This form is Maynard's *S. pilsbryi evolva* (pl. 43, fig. 65). Intergrades with the blue-white shells of the other end of the key occur. Very small specimens, length  $15\frac{1}{2}$  to 23 mm., were found by Mr. Maynard on a small tree and the immediately adjacent bushes, standing in a sandy tract about midway of the western portion of Goat Key, midway of the range of *S. p. evolva*. These dwarfed specimens, of which 75 were found, he has named *S. restricta* (pl. 43, figs. 66, 67). They vary from the blue-white tint of *pilsbryi*, to copiously mottled. Mouth dark inside. It is merely a colony of stunted individuals, with no other difference from the larger shells of the islet.

This series from Goat Key intergrades completely with one form or another of *S. glans* Maynard (not Küster), and *S. bimarginata* Maynard.

*Form from Gun Cay.*

Specimens collected by Dr. Wm. H. Rush (pl. 43, figs. 68, 69) are cylindric, moderately solid, sculptured with rather narrow riblets, 21 to 26 on the penultimate whorl. The parietal callus is thick and somewhat elevated, or moderate and appressed. The lip is reflexed, recurved, thickened and beveled; parietal lamella slender, rather small. They vary from white to copiously mottled, and are almost exactly like some specimens from the cemetery between Nassau and Waterloo pond. This is the most remote colony of *C. glans* yet known.

*C. BLANDI* Pilsbry & Vanatta. Pl. 44, fig. 81.

Shell solid and strong, cylindric-tapering, the latter 3 whorls approaching equality in diameter, those above slowly tapering to form a long cone, gradually passing into the cylindrical portion. Light grayish, with inconspicuous white flecking. Whorls 10, the nepionic  $2\frac{1}{4}$  corneous, smooth, the following  $2\frac{1}{2}$  weakly, distinctly ribbed, later  $4\frac{1}{2}$  to 5 whorls *very sharply and roughly, strongly ribbed*, ribs narrow and high, 19 to 22 on each of the two or three later whorls. Umbilicus compressed, rimate, the area behind columellar lip excavated, smooth. Aperture ovate, white within; peristome reflexed and recurved, its face not thickened; parietal callus heavy, forming a strong bar across the space between lip ends. Parietal tooth median, moderately strong.

Length  $27\frac{1}{2}$ , diam. 11; alt. of aperture  $10\frac{1}{2}$  mill.

Length  $26\frac{3}{4}$ , diam. 11; alt. of aperture 10 mill.

Bahamas: *Turk's Island*.

*Cerion blandi* PILS. & VAN., Proc. A. N. S. Phila. 1896, p. 334, pl. 11, f. 7.

This species resembles the more slender forms of *C. glans* in general figure and the stout parietal callus; but the ribs are conspicuously different, peculiarly rough and unfinished in appearance, somewhat like *C. felis*. The locality suggests that it may group elsewhere than with *C. glans*, but the conchological characters remind one only of the *glans* group. (Dedicated to Thomas Bland.)

*C. MARTINIANUM* (Küster). Pl. 44, figs. 75, 76, 77.

Shell shortly rimate, solid, cylindric-tapering, the apical cone rather long and gradually passing into the subcylindric portion; yellowish-white or flesh-tinted, uniform or inconspicuously mottled with darker. Whorls 9, slightly convex, the first smooth, next finely striate, the striæ gradually increasing in size to moderately strong riblets, 25 to 28 on the penultimate whorl. *A furrow below and parallel to the suture defines a subsutural band which appears beaded by the ends of the riblets.* Aperture ovate, white or pale yellow, the lip reflexed, moderately thick; parietal callus rather heavy, appressed. Parietal lamella short, axial lamella small.

Length 20.5, diam. 8.7 mill.

Length 18.5, diam. 9 mill.

Bahamas?

*Pupa martiniana* KÜSTER, Conchyl. Cab. p. 75, pl. 11, f. 3, 4, 4\*. —PFR., Monogr. ii, p. 324. —SOWB., C. Icon. pl. 2, f. 16. —*S. martensi* MAYNARD, Contrib. to Sci. ii, p. 182.

The habitat of this species is still unknown, although it is not especially rare in the older collections. Named for F. H. W. Martini, author of the earlier volumes (1769–1777) of the *Conchylien Cabinet*.

## XII. Group of *C. martensi*.

Shell sculptured with *very fine, close rib-striæ* or smooth; usually variegated richly with dark, irregular stripes; teeth small; parietal callus thin or heavy, but *not* forming a straight raised ledge.

As in the allied *C. maritimum* group of Cuba, some species are dimorphic, having both smooth and striate forms; and they vary

from a richly striped color-pattern to pure white. These variations are apparently not racial.

Various members of the groups of *C. maritimum*, *C. cyclostoma*, *C. crassilabris*, *C. gubernatorium* and *C. glans*, approach forms of this group in sculpture.

Three species, *martensi*, *multistriatum* and *marmoratum*, are from the Crooked Island group. *C. eximium* is from Cat Island, *agrestinum* from New Providence, and *bendalli* from Abaco. The localities of *C. gruneri* and *C. fordii* are unknown. Perhaps *C. venustum* Poey (p. 203) belongs to the group.

*C. EXIMIUM* (Maynard). Pl. 38, figs. 76, 77, 78.

Shell deeply rimate, moderately solid, cylindric-oval; *white, copiously striped with dark chestnut; densely and finely rib-striate*. Whorls  $9\frac{1}{2}$ , scarcely convex, the last paler at the base, the umbilical area impressed. Terminal cone rather short, with convex outlines, the apical whorls brownish-corneous. Aperture ovate, dark bluish-gray within; peristome narrowly reflexed, white, thick, the margins joined by a *rather strong parietal callus*, thin in the middle, thick at the sides, or thick throughout. No noticeable axial lamella. Parietal lamella very small, rather short; *behind it a low, rounded ridge revolves upward into the penultimate whorl, there being an excavation or gutter encircling the axial pillar* (fig. 78).

Length  $23\frac{1}{2}$ , diam.  $9\frac{1}{2}$ –10 mill.

Length 22, diam. 9 mill.

Bahamas: *Cat Island*.

*Strophia eximea* MAYN., Contrib. to Sci., ii, p. 177, 178, fig. 59 a, b, 61 a, c (December, 1894).

In this species, of which part of the original lot is before me, the striation is perceptibly less fine than in *C. martensianum*. The ridge running inward from the inner end of the parietal lamella seems to be constant and characteristic. Mr. Maynard mentions very small specimens without giving the dimensions.

Var. *FRATERNUM*, n. v. Pl. 38, figs. 79, 80.

Shell finely rib-striate, streaked and striped with reddish-brown on a white ground, as in *C. eximium*, from which it differs in the following particulars: The form is short, broad and oval; whorls  $8\frac{1}{2}$ ; umbilical area much smaller; interior without a spiral ridge and gutter encircling the central column; parietal lamella decidedly stronger.

Length  $17\frac{2}{3}$ , diam. 9 mill.

Length  $14\frac{2}{3}$ , diam.  $7\frac{1}{2}$  mill.

*San Salvador*, (Bland).

*C. AGRESTINUM* (Maynard). Pl. 38, figs. 81–85.

Shell shortly rimate, varying from oval to cylindric, rather thin; whitish or white, copiously striped with blackish-brown or red-brown; densely and finely rib-striate. Whorls  $9-10\frac{1}{2}$ , the upper ones flat, last two slightly convex; terminal cone rather straightly conic, the apex obtuse. Aperture ovate, dark within, the peristome narrowly reflexed, whitish. Parietal lamella small; axial lamella obsolete at the aperture; parietal callus thin and transparent.

Length 20, diam. 9 mill. Length  $15-18\frac{1}{2}$ , diam. 8 mill.

Length  $21\frac{1}{2}$ , diam.  $8\frac{1}{4}$  mill. Length 26, diam. 10 mill.

Bahamas: *New Providence*, on the south side, about opposite Nassau, in pine woods with some palms, about half a mile from the shore (Maynard).

This species differs from *C. eximium* in the thinner lip and parietal callus, and in completely wanting the peculiar internal ridge and gutter described in that species. Mr. W. Bendall collected specimens varying from heavily striped to pure white (pl. 38, figs. 82, 83, 84), the intermediate specimens having sparse livid streaks on a whitish ground, the base fleshy or bluish. Figure 85 is from a specimen received from Mr. Maynard, representing his form no. 1.

It has finer, closer riblets than *C. glans varium*, which differs moreover in the straight parietal ledge. *C. martensi* is more finely striate.

*C. BENDALLI* Pilsbry & Vanatta. Pl. 44, fig. 84.

Shell *very shortly rimate*, cylindric, with obtuse, straightly conic terminal cone; thin, white, copiously mottled and striped with brown and rust-brown; the apical whorls corneous-brown. Sculpture of delicate riblets a little narrower than their intervals, about 34 on the penult. whorl, much weaker on the base. Whorls  $10-10\frac{1}{2}$ , very slightly convex. Aperture *dark purplish-brown inside*; peristome rather narrowly reflexed, white; parietal callus thin and translucent; *parietal tooth very small*, short.

Length  $19\frac{1}{2}$ , diam.  $8\frac{1}{3}$  mill.

Length  $21\frac{1}{2}$ , diam.  $8\frac{2}{3}$  mill.

Bahamas: *Abaco* (H. D. Van Nostrand).



*C. abacoense bendalli* P. & V., Proc. A. N. S., Phila., 1896, p. 332, pl. 11, f. 13.

The exceedingly short umbilical chink shows that this form is probably related to *C. abacoense*, rather than to the group of *C. martensi*, which it resembles in sculpture and color. It is here grouped with the latter on account of its superficial resemblance. A specimen about two-thirds grown is toothless. (Named for Mr. Wilfred Bendall, author of a list of land shells of the Bahamas.)

*C. GRUNERI* (Pfeiffer).

"Shell deeply rimate, cylindrical, rather solid, closely plicate; white, beautifully marbled with fulvous and chestnut; plicæ close, hair-like, nearly straight, as wide as the interstices. Apex conic, rather obtuse; whorls 11, a trifle convex, the apical smooth; last whorl somewhat compressed below the umbilical chink. Aperture semi-oval, fleshy-livid within, with an entering parietal and a deeply placed columellar tooth; peristome expanded, reflexed, the margins slightly connected. Length 29, diam. 11 mill.; aperture  $10\frac{1}{2}$  mill. long, 9 wide" (*Pfr.*). *Habitat unknown* (Gruner coll.).

*Pupa gruneri* PFR., Zeitschr. f. Malak. 1847, p. 15; Monogr. ii, p. 322.

Pfeiffer's description is given above. I have identified as *gruneri* some specimens of unknown locality (pl. 44, fig. 83) agreeing with Pfeiffer's diagnosis in coloration, sculpture and size. The parietal lamella is continued as a low fold into a dorsal position, being thus very long for this group. It is a larger species than *eximium*, with finer riblets, and broader than *marmoratum*. *C. martensi* is hardly distinguishable, having the same very fine, close rib-striæ. Cf. also *C. venustum* Poey.

*C. MARTENSI* (Weinland). Pl. 38, figs. 73, 74, 75.

Shell obliquely and deeply rimate, solid, oblong, closely hair-striate, variegated with brownish-corneous and whitish. Spire long, more ventricose above the middle, terminating in an obtuse cone. Whorls 11, nearly flat, the last exceeding one-third the total length, somewhat ascending in front, subcompressed at base. Aperture oval-lunar, brown inside, scarcely obstructed by the minute, deeply placed dentiform parietal callus; peristome thick, reflexed throughout, the margins joined by a rather thick callus; no columellar fold.

Length 30, diam.  $11\frac{1}{2}$  mill.; aperture with peristome 11 mill. long (Weinl.).

Bahamas: *Crooked Island* (Weinland).

*Pupa martensi* WEINL., Malak. Bl. ix, 1862, p. 194.—PFR., Novit. Conch. p. 364, pl. 84, f. 3-5; Monogr. vi, p. 290.—SOWB., C. Icon. pl. 2, f. 15 (bad).

This species is distinguished by its *extremely fine, close striation*, which is perhaps more minute than in any other species. The color-pattern of ragged stripes is common to allied forms. The specimen before me, received from the author, has been inhabited by a hermit crab, and I fancy that the absence of the usual axial, and small size of the parietal lamella, noted by Weinland in his original description, may have been due to the wear caused by similar occupants of all the specimens. Many specimens are smaller than the type. That before me measures 26 mill. long, 10 wide. A still smaller one is figured by Pfeiffer, from the original lot (fig. 73).

*C. MULTISTRIATUM* Pilsbry & Vanatta. Pl. 44, fig. 82.

Shell small and rather thin, shortly rimate, short cylindrical; white, longitudinally marbled with gray or chestnut-brown. Whorls 8 to  $8\frac{1}{2}$ , the latter two or three about equal in diameter, the rest rapidly tapering, apex obtuse. Sculptured with excessively fine, close, sharp thread-like striæ, apical 2 whorls smooth. Aperture rounded ovate, obliquely truncate; peristome narrowly reflexed; parietal callus moderate or very thin; axial fold median, moderate; parietal tooth extremely small.

Length 17, diam. 7; alt. of aperture  $6\frac{1}{2}$  mill.

Length 14, diam. 7; alt. of aperture 5 mill.

Bahamas: *Crooked Island* (Bland).

*C. multistriatum* P. & V., P. A. N. S. 1896, p. 335, pl. 11, f. 8.

This is a small, extremely fine striated form with very small parietal tooth. It is represented in the collection of the Academy by five specimens, given by Mr. H. D. Van Nostrand, and originally from Bland. The striation is about as fine as in the much larger, usually more tapering, *C. martensi*, of which, indeed, this may prove to be a diminutive race.

*C. MARMORATUM* (Pfeiffer). Pl. 38, figs. 86, 87, 88, 89, 90.

"Shell rimate-perforate, subcylindric-ovate, solid, striatulate, glossy; snow-white, ornamented with longitudinal, chestnut, diaphan-

ous flames. Spire perceptibly tapering above, apex obtuse; whorls 10, nearly flat, the last plicate at the base. Columella obsoletely and deeply toothed; parietal fold moderate, deeply placed. Aperture semi-oval, livid brown inside; peristome thickened, reflexed, the margins converging above. Length 24, diam. scarcely 10 mill.; aperture 9 mill. long, 8 wide" (*Pfr.*).

Bahamas: *Fortune Island* (John B. Henderson, Jr.; Chas. T. Simpson).

*Pupa marmorata* PFR., Zeitschr. f. Malak., 1847, p. 83; Monogr. ii, p. 323; iii, p. 539; iv, 658; vi, 290.—KÜSTER, Conchyl. Cab., *Pupa*, p. 159, pl. 19, f. 10-12 —? SOWB., Conch. Icon., pl. 2, f. 10.—*Pupa chrysalis* var., DESH. in FÉR., Hist., pl. 156, f. 7, 8.—*Cerion marmoratum* Pfr., HENDERSON, Nautilus xv, p. 85, pl. 5, f. 3, 4 (Dec., 1901).

This beautiful species is well distinguished by its elegant coloration of irregular blackish-chestnut or pale chestnut stripes on a snowy ground, the comparatively smooth surface, which typically shows only faint growth-lines except at the base, which is usually plicate, and the rather long, ovate mouth, which is very dark within.

The contour is generally tapering, though cylindric specimens occur. Sometimes the last two or three whorls are finely and closely striate, the striæ varying from merely perceptible to moderately strong. The coloration seems unusually constant in the 38 examples before me, but in one lot of seven specimens, two are white, like *C. incanum*. The size varies, as usual.

Length  $31\frac{1}{2}$ , diam. 10 mill.

Length 28, diam. 10 mill.

Length 25, diam. 11 mill.

Length  $27\frac{1}{2}$ , diam.  $9\frac{1}{2}$  mill. (Fortune I.)

Length 20, diam.  $7\frac{1}{2}$  mill.

Length  $16\frac{1}{2}$ , diam. 7 mill.

The locality has hitherto been uncertain. I have seen specimens labeled "Cuba," "St. Thomas," "Porto Rico," "Cat Island," etc., but Messrs. Henderson and Simpson have recently collected typical specimens on Fortune Island, a small islet of the Crooked Island group; thus fixing its habitat.

One of the specimens from Fortune Island before me, referred by Henderson to *marmoratum*, is finely and sharply striate throughout, even on the cone of the spire. It thus approaches close to *C. eximium*.

*C. FORDII* Pilsbry and Vanatta. Pl. 38, figs. 67, 68, 72.

Shell cylindrical, the latter three whorls of equal diameter, those earlier forming a rather short, obtuse cone. Whorls 10 to  $10\frac{1}{2}$ , earlier two white, smooth, the following finely striated, striae or riblets evenly spaced though of variable closeness, in number 32 to 45 on the last or next to last whorl, not splitting or more numerous on the base of the shell, which is rounded, not compressed; umbilical chink short, subperforate. Color: longitudinally mottled with brown, ochre and snow-white; sometimes uniform white.

Aperture vertical or with the base somewhat advanced; parietal lamella about median, high, long and strong, extending backward about four millimeters. Columellar fold very slight, situated high. Peristome reflexed, its face much thickened; light brown or whitish; parietal wall generally heavily calloused.

Length 30, diam. of penult. whorl 12, alt. aperture  $12\frac{1}{2}$  mill.

Length 27, diam. of penult. whorl 12, alt. aperture  $10\frac{1}{2}$  mill.

Length  $28\frac{1}{2}$ , diam. of penult. whorl 11, alt. aperture 11 mill.

Form *submarmoratum* P. & V. (Pl. 38, figs. 69, 70, 71.) Like the type except that it is ribless, smooth with slight growth-wrinkles; sutures a little exserted and seam-like above. White, unicolorous or with irregular longitudinal dark fleshy brown stripes and sometimes ochraceous stains. The first post-nepionic whorl of the cone is usually striated. Aperture typical. *Bahamas.*

*C. fordii* P. & V., Proc. A. N. S., Phila., 1897, p. 365, figs. 1, 2, and var. *submarmoratum*, f. 3, 4; Nautilus, xii, p. 27, same figures reprinted.

Typical *C. fordii* exactly resembles externally a coarsely sculptured form of *C. dalli* from Inagua; but it has the internal armature of "*Strophlops*" or "*Maynardia*." It is a coarser, larger shell than *C. eximium* of Cat Island and *C. agrestinum* of New Providence, with far stronger development of peristome and teeth and more interrupted strigation. *C. fordii* has not the raised ledge across the parietal wall of *C. glans varium*, from New Providence, has stronger peristome and teeth, and is larger.

The pure white form of *C. fordii* resembles *C. abacoense*, but is less stout in the average, has a liver-tinted mouth and lip, and the parietal tooth is notably longer and stronger.

Form *submarmoratum* is a larger shell than *C. marmoratum*, stouter above, and with a much more developed parietal tooth. It

has not the expanded umbilical area of *C. regina eucosmium*, of Turk's Island.

White specimens of this variety are very similar to *C. eleuthera*, but do not taper gradually as that species, the angle of obliquity of the aperture is different, etc.

Several hundreds of this species were obtained by Mr. John Ford from a barrel of shells from the Bahamas, exact island unfortunately unknown. On comparison with the nearly complete series of *Cerion* in the collection of the Academy, it is evident that a new polymorphic species is before us, probably from an island or region of an island hitherto unexplored for this genus. Both the striate and smooth forms occurred either white or streaked, and so far as we can judge in nearly equal numbers. Transition forms are fully represented, though probably 95 per cent. of the specimens are either the one or the other.

Figures 71, 72 are examples of variation, selected as the most extreme uninjured specimens among some hundreds of shells examined.

#### Subgenus DIACERION Dall, 1894.

*Diacerion* DALL, Bull. Mus. Comp. Zool., xxv, p. 122.

The inner end of the rather short parietal lamella is contiguous to or continuous with a denticle, or a long, spirally-entering lamella; an infra-parietal denticle or parallel lamella is developed between the parietal lamella and the axis. Part or all of these lamellæ are sometimes absent. Axial fold developed. Shell ribbed. Type *C. dalli*.

This division contains two groups of species: those of Great Inagua, Bahamas, in which the lamellæ may be very long inside, and those of southern Cuba, in which, so far as we know, three comparatively short lamellæ are invariably developed, or the "parietal" and the "spiral" lamellæ may be united into one long lamella.

#### XIII. Group of *C. rubicundum* (Great Inagua).

The internal armature typical of this group is shown in pl. 45, fig. 88; but by shortening of the spiral (*s*) and infraparietal (*i*) lamellæ a condition exactly like the Cuban group of *C. striatellum* is sometimes produced (fig. 98). Further reduction leaves only the parietal lamella (pl. 46, fig. 10); and in *C. bryanti* even this may be lost. These stages of tooth development are demonstrated by the series before me to be in no way due to age; I speak of fully adult shells.

In the present stage of evolution of these organisms, such variations are not specifically or even varietally constant, except in the *average*. Adult individuals living side by side may exhibit various tooth arrangements, although the greater number of individuals in any given colony will agree. The grouping of the various local forms into conventional "species" is more or less arbitrary.

*Key to Species of Inagua.*

1. A rather short parietal lamella or none; no deeply-entering spiral lamellæ; length 16–23 mill.
  - a.* Dark brown with white ribs, or maculate. *bryanti*, p. 272.
  - a'*. Dull purple with white ribs, roseate above. *pudicum*, p. 273.
2. A denticle inward from the parietal, and another towards the axis; length 14–15 mill.; densely, finely striate. *heterodon*, p. 275.
3. Two very long parallel spiral lamellæ running within from the parietal lamella.
  - a.* Roseate above, purplish with white ribs below; length 22–25 mill.; riblets 23 to over 40 on penult. whorl.
 

*rubicundum*, p. 274.
  - a'*. Flesh-tinted with white riblets or brown and white maculate; length usually 30–36 mill., riblets 27–73.
 

*dalli*, p. 276.
  - a''*. White variegated with gray, the aperture white within.
 

*duplodon*, p. 276.

C. BRYANTI (Pfeiffer). Pl. 46, figs. 5–10, 13–16.

Shell shortly and deeply rimate, subperforate, oblong, solid; chestnut colored, with obtuse, white, rather distant riblets. Spire tapering in a somewhat obtuse cone, the apex pale corneous. Whorls 9 to 10, a trifle convex, slowly increasing, the last slightly ascending in front, somewhat compressed around the umbilical fissure. Aperture vertical, sub-oval, dark chestnut colored within; parietal fold small and deeply situated, columellar fold obsolete; peristome white, somewhat thickened, and narrowly reflexed, the margins joined by a whitish callus; right margin arcuate, the columellar margin dilated above. Length  $18\frac{1}{2}$  to 21, diam. 7 mill.; aperture with peristome  $7\frac{1}{3}$  mill. long, 6 wide (*Pfr.*).

*Southern part of Inagua* (W. W. Miller).

*Pupa bryanti* PFR., Malak. Bl., xiv, 1867, p. 130; Novit. Conch.,

p. 366, pl. 84, f. 14, 15; Monographia, vi, p. 292.—SOWERBY, C. Icon., xx, pl. 1, f. 1.

Pfeiffer's description is given above, and his figures are reproduced on my plate (figs. 5, 6).

This differs from other Inaguan species in the simple, small and short parietal lamella, often entirely wanting. In the typical form the color varies from chocolate with white riblets to maculate or nearly white throughout. The ribs extend upon the cone, only the first  $1\frac{1}{2}$  whorls being smooth, and on the penult. whorl they number as follows:

Length  $21\frac{1}{2}$ , diam. 8 mill.; ribs on penult. whorl 24.

Length 21, diam. 9 mill.; ribs on penult. whorl 29.

Length 18, diam. 9 mill.; ribs on penult. whorl 31.

Length  $16\frac{1}{2}$ , diam. 8 mill.; ribs on penult. whorl 30.

Three of these specimens are figured, pl. 46, figs. 7, 8, 9. The parietal callus, while rather strong and cord-like in some specimens, is quite thin in others, and the ribs are often distinctly seen in the interior. In one tray of 17 specimens, 6 have the parietal lamella more or less developed; in the others it is completely wanting.

In another tray of specimens (pl. 46, figs. 13–16) *the whorls of the cone are nearly smooth, without riblets*, and elegantly marbled, and the form varies from tapering to cylindric; peristome narrow, the aperture dark purplish-brown within. The parietal lamella is either absent (fig. 16), present, small and short (fig. 15), or contiguous to a spiral lamella a half-whorl long, an infra-parietal lamella running parallel to it (figs. 13, 14); these variations occurring among shells of apparently the same age, and agreeing in all other features and variations.

Var. *pudicum* Pilsbry, n. v. Pl. 46, figs. 17, 18.

Still other shells exactly reproduce the color-pattern of *C. rubicundum*. The lower two or three whorls are dull purple between white ribs, this ground-color changing above to rose. Riblets on penult. whorl 27 to 31; and becoming very fine and low on the cone. The interior is brown or ochre-brown. Parietal lamella rather better developed than in typical *bryanti*. Of 12 specimens opened, 11 have the simple "Maynardia" parietal lamella, and one has a short accessory denticle beyond it, corresponding to the outer or spiral lamella of *C. rubicundum*.

Specimens measure:  $23\frac{1}{2} \times 9$  mill.;  $20 \times 8\frac{3}{4}$  mill.;  $17 \times 7$  mill. The brown or white lip is somewhat more thickened than usual in *C. bryanti*.

As to the genesis of this set of shells, I am much inclined to believe it an independent stock which has arisen from *C. rubicundum* by degeneration of the lamellæ, and in this feature has converged to the condition of *bryanti*. The specimens are from the Robert Swift and H. D. Van Nostrand collections, in that of the Academy.

*C. RUBICUNDUM* (Menke). Pl. 45, figs. 86-90.

Shell very shortly rimate, solid, cylindric or pillar-shaped, *white, becoming rose-colored above, or purple with white riblets, roseate above*, and sometimes light brownish-yellow near the apex. Whorls about  $10\frac{1}{2}$ , but slightly convex, the last four (three to five) of about equal diameter, those above forming a moderately long, obtuse cone. Sculpture of rather close and fine riblets, normally 25 to 40 on the penultimate whorl, but varying within wider limits. Aperture truncate-ovate, dark purple within, the peristome usually paler, brown or whitish, very narrowly reflexed, slightly thickened, continued in a strong, usually straight callus across the parietal wall. Parietal lamella continuous with or contiguous to a spiral lamella, which extends inward about one whorl; an infra-parietal lamella revolves parallel with it, penetrates a little deeper, but is not visible in a front view in the aperture. Axial lamella inconspicuous from in front, often immersed.

Length 25, diam.  $9\frac{1}{2}$  mill.

Length 22, diam.  $8\frac{1}{2}$  mill.

Inagua: *N.-W. point and east end, on the opposite side of Lake Rosa* (Van Nostrand); *scrub lands just back of Matthewstown* to the 'salina' in the interior, clinging to the trunks of small trees (Maynard).

*Turbo ura* Brooks, An Introduction to the Study of Conchology, pp. 126, 163, pl. 8, f. 101 (London, 1815); and Leipzig edition, Anleitung zu dem Studium der Conchylienlehre, p. 110 (1823).—*Pupa rubicunda* MKE., Verzeichniss der Ansehnlichen Conchylien-Sammlung des Freiherrn von der Malsburg, p. 8, no. 151 (Pyrmont, 1829); Syn. Meth. Moll. Museo Menckeano, edit. 2, p. 34 (1830).—KÜSTER, Conchyl. Cab., *Pupa*, p. 76, pl. 9, f. 8, 9; pl. 10, f. 3, 4, with var. *variegata* Küst.—*Pupa alvearia* Dillw., PER., Monogr. ii, p. 315; iii, 537; iv, 659; vi, 291.—DESHAYES, in Fér., Hist. p. 211, pl. 156,



f. 3, 4.—KÜSTER, Conchyl. Cab., p. 80, pl. 11, f. 18 (= *ianthina* Mayn.).—SOWB., C. Icon., pl. 3, f. 23 *a, b*.—*Strophia cylindrica* MAYNARD, Contrib. to Science, iii, p. 34, pl. 7, f. 2, 4 (March, 1896).—*Strophia ianthina* MAYN., Contrib. to Sci. i, p. 69, pl. 2, f. 13 (July, 1889).—*S. pallida* MAYN., t. c., p. 70, pl. 2, f. 14.

The typical form is rather fine-ribbed, but the variation among specimens from one place is astonishing, though there are doubtless fine- and coarse-ribbed colonies. The teeth or lamellæ are also exceedingly variable among fully adult and externally similar shells. The outer or spiral lamella, while typically long, is often reduced to a length of one or two mill., and sometimes the inner or infra-parietal lamella is short or even wholly obsolete. Maynard's *S. cylindrica* is a synonym of typical *C. rubicundum*.

Form *ianthinum* Mayn. (pl. 45, figs. 91, 92, 93). Usually dull, dark purple between white ribs, becoming orange or rose above; *ribs wide-spaced*, about 24 on the penult. whorl; the shell often more slender than *rubicundum*. Type locality, "rocky plains between the elevations that skirt the southern shore of Inagua, and the extensive salt lake of the interior, about 20 miles from Matthewstown, on the scattering shrubbery."

Form *pallidum* Mayn. (pl. 45, fig. 94). Externally flesh-color, deepening to pale purple on the lower whorls, the peristome, riblets and apex white; interior pale purple. Riblets rather wide-spaced, 23 on the penult. whorl. Type locality, "the cultivated fields that lie on the slopes of the hills that border the southern shores, between 15 and 20 miles from Matthewstown," Inagua.

Both of these forms have the lamellæ as in *C. rubicundum*.

Var. HETERODON Pilsbry, n. v. Pl. 45, figs. 96, 97, 98.

Shell small and thin, roseate with white ribs, or maculate with rose over part of the ribs. Sculpture of densely crowded, fine riblets, 46 to 48 on the penult. whorl. Whorls  $8\frac{1}{2}$ . Lamellæ as in *C. striatellum*—a short parietal not connected with a somewhat longer spiral lamella, with a small, short infra-parietal adjacent to the neighboring ends of the other lamellæ. Length 14 to 15, diam. 6 mill.

*Inagua* (R. Swift).

This is as "good" a species as any of the Diacerions, but while I have not seen intermediate specimens, I believe it to be a dwarf form of the *rubicundum* stock. The four specimens are essentially alike.

*C. DALLI* (Maynard). Pl. 45, figs. 99, 1, 2, 3, 4.

Shell rather large, solid, shortly rimate, cylindric; flesh-tinted, with white riblets, or nearly white. Whorls about  $11\frac{1}{2}$ , but slightly convex. *Sculpture of close, fine, white riblets*, typically fifty or more on the penultimate whorl, but varying within wide limits. Aperture truncate-ovate, dark purplish-brown within, the peristome white or brown, reflexed and thickened, the margins continuous by a strong parietal ledge. Parietal lamella rather low and deeply placed, continuous within with a long spiral lamella which extends inward about  $1\frac{1}{3}$  whorls; the almost equally long infra-parietal lamella parallel with it, and usually nearer than in *C. rubicundum*. Axial lamella inconspicuous from in front.

Length 22, diam. 10 mill.

Length  $31\frac{1}{2}$ , diam. 11 mill.

Length 33, diam.  $12\frac{1}{2}$  mill.

Length 36, diam.  $11\frac{1}{2}$  mill.

*Inagua.*

*Strophia dalli* MAYNARD. Contrib. to Science i, p. 128, 129, 135, f. 32, 33, pl. 13, f. 23 (October, 1889).

Larger than *C. rubicundum*. Typically with more numerous riblets and longer parietal lamellæ; but the large series before me shows such great variation that it is likely that specimens will be found intermediate between the two species.

Some specimens are nearly white, the intervals being only faintly tinted, and the aperture is yellowish-brown within. Others have a few stripes of rusty brown. In one lot of large specimens the maculation is like that of *C. marmoratum*, and the riblets vary from 27 to 56 on the penultimate whorl. The most finely ribbed shell before me has 73 rib-striæ on the penultimate whorl.

One specimen, among a large number opened, has no entering lamellæ behind the well developed but short parietal lamella, being a "*Maynardia*" in the teeth, while it has all other characters of the *C. dalli* with which it occurred. It is a fresh shell, quite unworn inside.

*C. DUPLODON* Pilsbry & Vanatta. Pl. 45, fig. 95.

Shell shortly rimate, rather thin, cylindrical, the latter three whorls of about equal diameter, those above slowly tapering to form a rather long, convex cone. White, variegated with gray-white. Whorls  $10\frac{1}{2}$ , slightly convex, two nepionic smooth, those of the cone

very finely, sharply striate, the latter four with coarser riblets, much narrower than their intervals, about 30 in number on the penultimate whorl.

Aperture ovate, large and open, white, higher than wide. Peristome expanded and recurved, rather thick; axial lamella basal; parietal lamella narrow, nearly a half whorl long; an accessory infraparietal lamella ascends around the root of the columella, but at the apertural termination approaches close to the main parietal lamella; its termination visible in a front view.

Length 29, diam.  $10\frac{1}{2}$ , long axis of aperture  $11\frac{1}{2}$  mill.

*Bahamas.*

*C. duplodon* P. & V., Proc. A. N. S. Phila. 1896, p. 337, pl. 11, f. 26.

This is an albino form of the *Diacerion* group, differing from *C. rubicundum* and its immediate allies in the greater distance between the two parietal lamellæ within, the more expanded aperture and delicate riblets.

#### XIV. Group of *C. striatellum* (Cuba).

*Paracerion* P. & V., Proc. A. N. S., Phila., 1895, p. 206 (June 18).—*Tridentistrophia* MAYNARD, Contrib. to Science, iii, p. 9 (March, 1896).

The parietal lamella is long, extending inward to a dorsal position, and usually interrupted or partially so in the middle, when it would be described as two lamellæ, one behind the other. A short infraparietal lamella lies between the middle of the parietal lamella and the axis. Axial lamella and other characters as usual.

This group is either an incipient or a degenerate stage of the *Diacerion* branch; and in the present state of our knowledge, I see no means of deciding which. The armature of the parietal wall is exactly paralleled by that of some degenerate forms of *Diacerion* from Inagua.

Three species are known: *C. tridentatum*, smooth, white with some zigzag gray marbling, and the aspect of *C. incanum*; *C. striatellum*, very strong, densely rib-striate, with short mouth and thick peristome, and *C. basistriatum*, a nearly smooth and thin species otherwise resembling *striatellum*.

C. STRIATELLUM ('Fér.' Guérin). Pl. 46, figs. 19-23.

Shell shortly rimate, cylindric, *very solid and strong*; flesh-colored with white striae; or white, and more or less maculate with fleshy. Sculpture of fine, close-set, rounded rib-striae, about 45 in number on the penultimate whorl. Last three whorls wide, those above forming a rather *straight-sided cone*, the apex obtuse. Whorls about  $9\frac{3}{4}$ , nearly flat, the last well-rounded beneath, ascending in front. Aperture ovate or circular, the peristome reflexed, *thick* in mature shells, often so much thickened inside as to reduce the opening to an *almost circular* contour; the *parietal callus is thickened into a strong ledge*. Parietal lamella strong and *long*, making over one-third of a revolution, a little narrower or *interrupted in the middle*, with a *small denticle* at this point between the lamella and the columellar axis. Axial lamella small or inconspicuous.

Length 21 to 23, diam. 9 mill.

Length 17, diam. 8 mill.

Southern Cuba: *Cabo Cruz* (Arango, Gundlach *et al.*).

*Helix striatella* FER. in coll.—*Pupa striatella* FÉR., GUÉRIN, Iconographie de Règne Animal de G. Cuvier, Moll., pl. 6, f. 12.—DESH. in FÉR., Hist., ii, p. 209, pl. 156, f. 11-13.—*Cerion striatellum* PILS. & VAN., Proc. A. N. S., Phila., 1896, p. 326.—*Strophia striatella* MAYNARD, Contrib. to Sci., iii, p. 9, pl. 2, f. 5, 6.—*Pupa striatella* (in part) PFR., Monogr., ii, p. 323; Malak. Bl., 1854, p. 207, pl. 3, f. 11, 12, 13, 14 (?).—Not *Cerion striatellum* FÉR., DALL, Bull. M. C. Z., xxv, no. 9, pl. 119. Not *C. striatellum* DALL & SIMPSON, Moll. of Porto Rico, p. 376, pl. 53, f. 4, = *C. crassilabris*.

A common shell at Cabo Cruz, the southwestern cape of Santiago de Cuba province. Other localities must be viewed with suspicion. "Haiti, Porto Rico, Anegada" of Pfeiffer's *Monographia* are records based upon the externally similar *C. crassilabris* and *yumaensis*. But in the Malakozoologische Blätter, i, 1854, Pfeiffer reports *P. striatella* from Punta de Jicaco, Cayo de Cinco Leguas and Cayo Iguana, off the northern shore of Matanzas province. I have no idea what these shells may be, but it is not likely that they are identical with the Cabo Cruz *striatellum*. Probably they belong to the *maritimum* group.

This species differs externally from *C. crassilabris* in being *more straightly conic and less obtuse above*, and in the strongly-developed parietal callus. It is the representation of these two features which

caused me to identify Guérin's figure with the present species, rather than with *C. crassilabris*, as some authors have done. There is more or less uncertainty about most of the figures purporting to represent *striatellum*, on account of our ignorance of the internal structure of the specimens delineated. Guérin's figure is copied on pl. 46, fig. 19, but my artist made the apex too obtuse.

This species may or may not be the *Pupa striatella* of Humphrey's *Museum Calonnianum*, p. 64, as that is undefined, though doubtless a *Cerion*.

B. BASISTRIATUM Pils. & Van. Pl. 46, figs. 26, 27.

Shell rather *thin*, cylindrical, the later three whorls of about equal diameter, those above tapering rapidly, forming a straight-sided cone about one-third the shell's length. *Surface rather smooth and glossy*. Two corneous nepionic whorls smooth; succeeding one or two turns densely and regularly striated; rest of the shell smooth except for slight irregular growth-wrinkles, down to the last whorl, which is finely costulate. Color white with irregular longitudinal streaks and blotches of brown. Whorls 9, hardly convex, the last ascending slowly in front, rounded below, with a short umbilical rimation. Aperture about four-tenths the shell's length, rounded-ovate, nearly as wide as high, brownish within. Peristome thickened, outer lip expanded but scarcely reflexed, columellar lip reflexed; the terminations connected across the parietal wall by a strong, elevated callous ledge. Axial lamella small as seen from the mouth; parietal lamella small, often double, moderately long; a small denticle to the left of, and an elongated lamella behind and to the right of its inner end.

Length 18, diam. 9; apert., alt. 7, width  $6\frac{1}{2}$  mill.

Length  $16\frac{1}{2}$ , diam. 8; apert., alt. 6, width  $5\frac{1}{2}$  mill.

*Cabo Cruz, Cuba.*

*Cerion basistriatum* P. & V., Proc. A. N. S., Phila., 1896, p. 335, pl. 11, f. 28.

This species differs from *C. tridentatum* in its round aperture with strong parietal callus, and the costulate basal volution; from *C. striatellum* it differs in the much smoother surface, *thinner substance*, etc. In the arrangement of parietal lamellæ, it is like the two species mentioned. It may prove to be a variety of *C. striatellum*, but I have not seen intergrading specimens.

*C. TRIDENTATUM* Pilsbry & Vanatta. Pl. 46, figs. 24, 25.

Shell shortly rimate, moderately thick, strong, cylindrical, the latter three whorls of about equal diameter, those preceding tapering to form a long cone about one-third the total length of shell. Chalky-white, mottled with corneous, especially on the cone, rather polished, *the surface smooth* except for slight growth-wrinkles, but a few whorls following the two smooth, corneous nepionic ones are seen under a strong lens to be densely striated, and the base of the last whorl has irregular striae. Whorls 10, with just perceptible convexity, sutures well marked below. Last whorl ascending as usual. Aperture *ovate*, about four-tenths the total length, much higher than wide, light brown in the throat; peristome rather thin, narrowly reflexed, white; columellar margin well reflexed; parietal callus thin, its edge indistinct, axial lamella small or inconspicuous from front aspect. Parietal lamella small, short, central, with a still smaller accessory denticle to the left of and beyond its inner termination, and another slightly to the right and deeper within; all visible without cutting the shell.

Length  $27\frac{1}{2}$ , diam. 10; apert., alt. 11, width  $8\frac{3}{4}$  mill.

Length 25, diam. 9; apert., alt. 10, width  $7\frac{1}{2}$  mill.

*Cuba* (Robert Swift coll., A. N. S. P.).

*C. tridentatum* P. & V., Proc. A. N. S., Phila., 1895, p. 206; 1896, pp. 326, 337, pl. 11, f. 27.

This species superficially resembles closely *C. incanum* of Key West, but differs in the ovate form of the aperture, sculpture of the earlier whorls, and the teeth of the aperture.

#### Subgenus EOSTROPHIA Dall, 1890.

Shell wanting both parietal and axial lamellæ.

CERION ANODONTA (Dall). Trans. Wagner Free Inst. Sci., iii, p. 13, pl. 1, figs. 8c, 8d.

Oligocene: 'Silex Beds at Ballast Point and Old Tampa Bay, west coast of Florida.

CERION ANODONTA FLORIDANUM (Dall). *L. c.*, fig. 6.

Oligocene: Ballast Point.

#### UNDESCRIBED OR UNRECOGNIZED SPECIES.

*Pupa striatella* [Humphrey], Museum Calonnianum, p. 64

(May 1, 1797). Merely listed without description or references, as are the following:

*Pupa rubra* [Humphrey], l. c. West Indies. Probably *C. rubicundum*.

*Pupa clathrata* [Humphrey], l. c. West Indies.

*Pupa pinguis* [Humphrey], l. c. West Indies.

*Turbo alcearia* Dillwyn. Descript. Catal., II, p. 862, = *Bulimus fusus* Brug., Encycl. Méth., I, p. 348, = Lister, pl. 588, f. 49, is an unrecognizable form, similar to *Gibbus palanga*.

*Helix* (*Cochlodonta*) *decumana* Fér., Prodr., p. 59 (undescribed) = *Pupa decumana* Gray, Ann. of Philos., N. ser., 1825, IX, p. 413, referring to Lister, pl. 588, f. 47, is unrecognizable with any reasonable degree of certainty, but may be *Pupa multicosta* Küster. Crosse attempted to substitute *decumana* for *regia*, having found the original specimens; but his course was untenable.

*Pupa capillaris* Beck, Index Molluscorum, p. 82. Undescribed. "I. Antill."

*Pupa elegans* Beck, l. c., p. 82. Undescribed. "I. Antill."

*Pupa conus* Beck, l. c., p. 82. Undescribed. "I. Antill."

*Pupa strobilus* Beck, l. c., p. 82. Undescribed. "I. St. Domingo."

*Pupa utriculus* Menke, Verzeichniss der ansehnlichen Conchylien-Sammlung des Freiherrn von der Malsburg, p. 8 (1829). "Shell ovate, very obtuse, white, pellucid, the whorls swollen, upper ones longitudinally striate, lower reticulate-veined. Umbilicus compressed, linear, aperture ovate, the columellar lip one-toothed, outer lip with reflexed margin. Length 1 inch 3 lines, width 10 lines." Locality not stated.

*S. orbicularis* Maynard. Contributions to Science, I, pl. 16, f. 6a, b. Undescribed; no locality assigned.

*S. viola* Maynard. Contr. to Sci., I, pl. 16, f. 5a, b. Undescribed; no locality assigned. Looks like *C. tenuilabris*.

#### ADDENDA TO BULIMULIDÆ, ETC.

STROPHOCHEILUS (DRYPTUS) INDENTATUS Da Costa. Pl. 49, f. 7.

Shell oblong-ovate, imperforate, rather thin, rudely decussated striate and finely indented; rose-brown, ornamented with rufous streaks and spots. Spire short, the apex obtuse, roseate, transversely striate and punctate-granulose, somewhat crenulated at the sutures.

Whorls 5, a little convex. Columella roseate, nearly erect. Aperture ovate, a little exceeding half the total length, lead-colored within, peristome narrowly reflexed, roseate, at the base forming an indistinct angle with the columella. Length 44, diam. 23, length of aperture 24, width 13 mill. (*Da Costa*). *Ecuador*.

*S. (D.) indentatus* DA COSTA, Proc. Malac. Soc. Lond. iv, p. 239, pl. 24, f. 8 (Oct., 1901).

"This shell with a few other examples was collected many years ago by the late Mr. Clarence Buckley during his extensive travels in Ecuador; it bears at first sight a resemblance to *S. guerini* Pfr., from which it differs in the strong reticulated sculpture on the whorls, its swollen and obtuse spire, and especially in the angular form of the base of the aperture, at its junction with the columella; moreover, *S. guerini* has hitherto been found only in Venezuela, and in the opinion of both Mr. Reeve and Mr. Pilsbry, is but a small variety of *S. moritzianus*, a view in which the writer fully concurs." (*Da Costa*.)

#### BULIMULUS COMPACTUS Fulton.

Shell oblong-conic, thin, very narrowly umbilicated: apical whorls reddish brown, others whitish, with numerous narrow oblique stripes of red-brown; the last three have a rugose and somewhat malleated appearance; nucleus smooth, except for some short, oblique, microscopic striæ at the suture; whorls 6, moderately convex, rapidly increasing in size, the last equal to two-thirds the height of the whole shell, aperture oval, interior light brown, peristome thin, simple. Alt. 16, maj. diam. 9 mill. (*Fulton*). *Olicani, Bolivia*.

*Bulimulus compactus* FULTON, Ann. and Mag. Nat. Hist. (7th Ser.), ix, p. 69 (Jan. 1, 1902).

Near *B. exornatus* Rve., and *B. cinereus* Rve., but differing from both in having fewer and more rapidly-increasing whorls. *B. exornatus* has strong radial riblets on the apical whorls, whereas they are almost smooth in *B. compactus* (*Fulton*).

#### AMPHIDROMUS PERAKENSIS Fulton. Pl. 60, figs. 19, 20, 21.

"Shell dextral or sinistral, solid, general form as figured, imperforate, polished, yellow with a narrow conspicuous band at the suture; whorls  $7\frac{1}{2}$ , slightly convex, with weak oblique striæ or lines of growth; columella bearing a thin and somewhat flat projecting plate, situated interiorly at about a third of a revolution from the exterior;



peristome white, thick, expanded and slightly reflexed, margins connected by a transparent raised callus, columellar portion triangularly dilated above, somewhat angular below; aperture sub-ovate, whitish within. Alt. (sinistral specimen) 48; maj. diam. 26 mill. Alt. (dextral specimen) 50; maj. diam. 27 mill. (*Fulton*).

*Perak* (Grubauer)

*Amphidromus perakensis* FULTON, Journ. of Malacology, viii, p. 104, pl. 9, f. 8-10 (Dec. 30, 1901).

"At first sight one could easily take this species to be one of the numerous varieties of *A. perversus*, but on holding the shell obliquely, the very characteristic projection becomes conspicuous. This plate appears, from an exterior view, to be thick, but on breaking away the wall of the shell, it is seen to be quite thin. All the numerous specimens collected are quite constant in the possession of this peculiarity, although it is more prominent in some than in others." (*Fulton*.)

This is evidently allied to *A. aureus leucoxanthus*. I have described and figured a form having a columellar lobe, Man. Conch., xiii, p. 164, pl. 54, figs. 76, 77.

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#### ERRATA.

On pages 13 and 18 I placed *Bulimus sinistrorsus* Moss & Webb under *Draparnaudia lifuana*. Having examined specimens received from Mr. Moss I find that the form was correctly identified. It is a new variety of *D. sinistrorsa* (Dh.), separable by its less depressed last whorl and less oblique aperture, which is produced basally more than in *sinistrorsa*, and less tangentially; somewhat as in *D. crossei*. The *Helix* (*Geotrochus*) *sinistrorsa* Melv. & Stand. (p. 18), is also to be deleted from the synonymy of *D. lifuana*, as it was apparently based upon specimens of the same lot.

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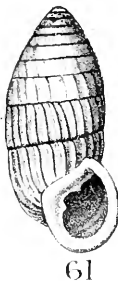
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CERION.

PLATE 42.



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CERION.

PLATE 43.



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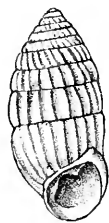
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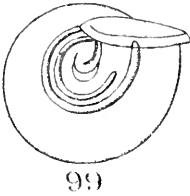
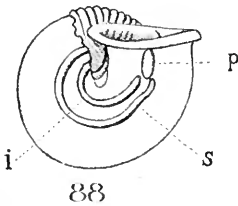


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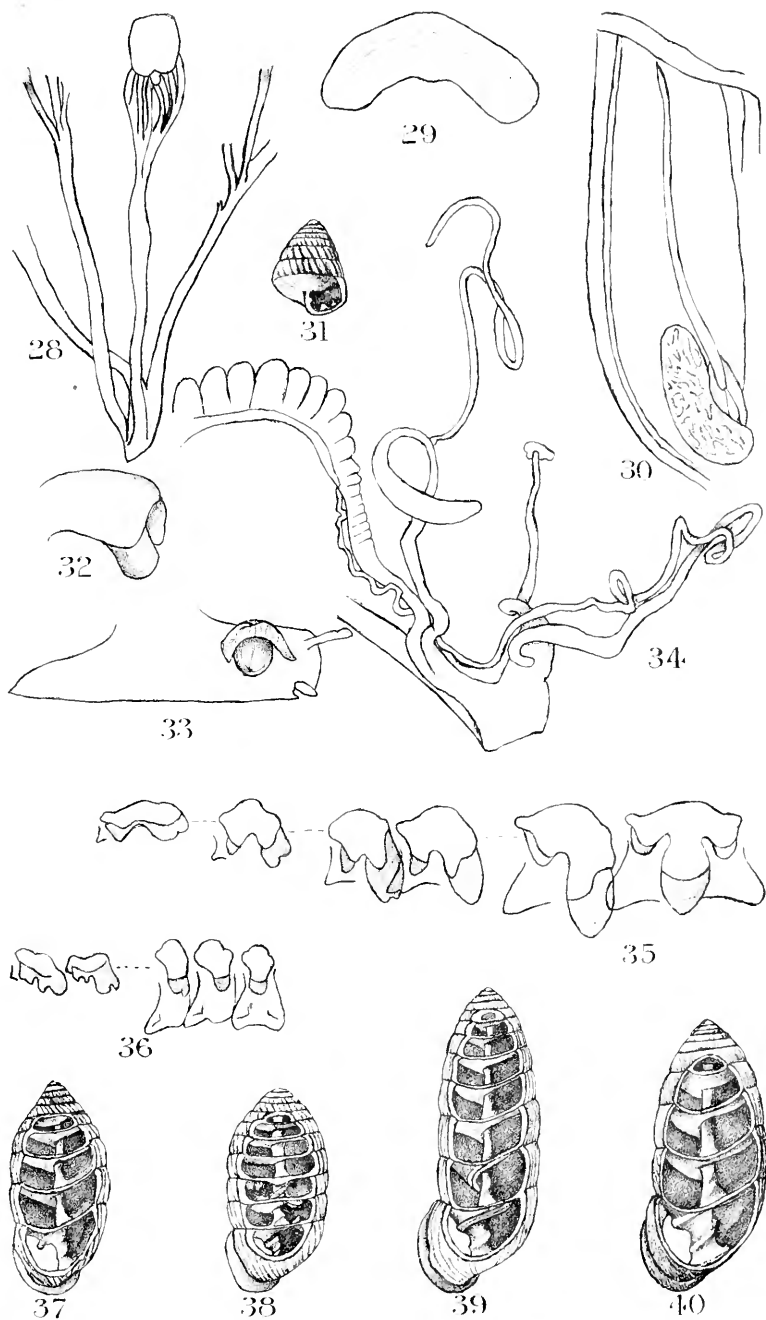




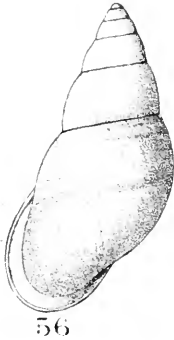
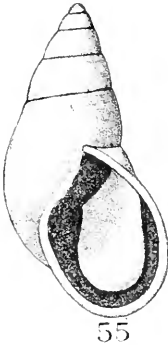
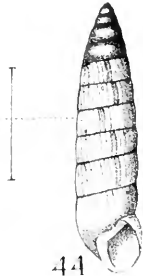
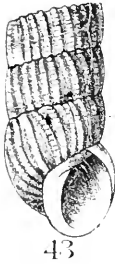
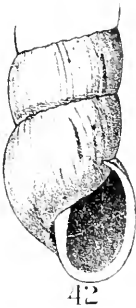




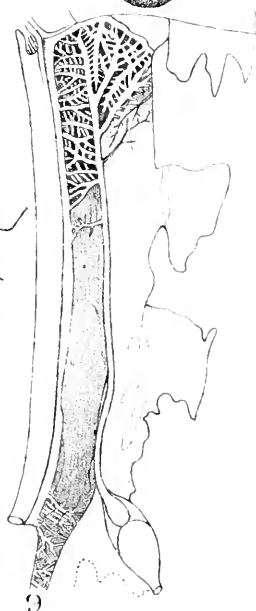
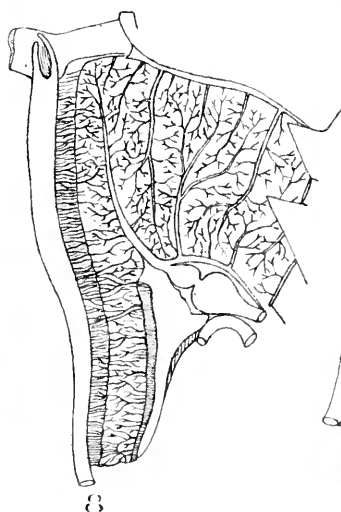
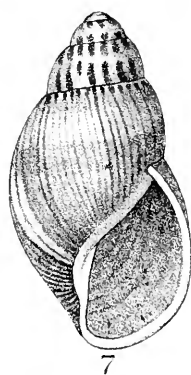
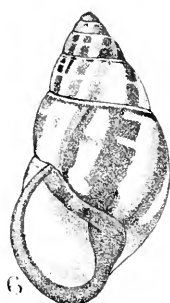
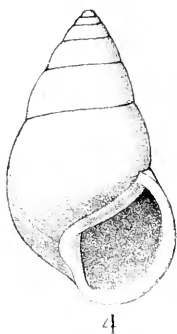
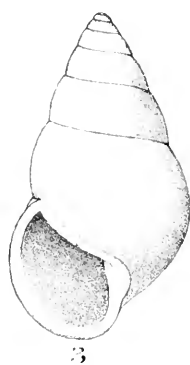
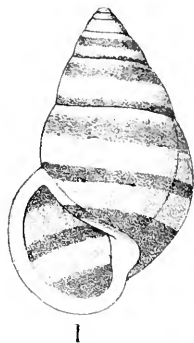




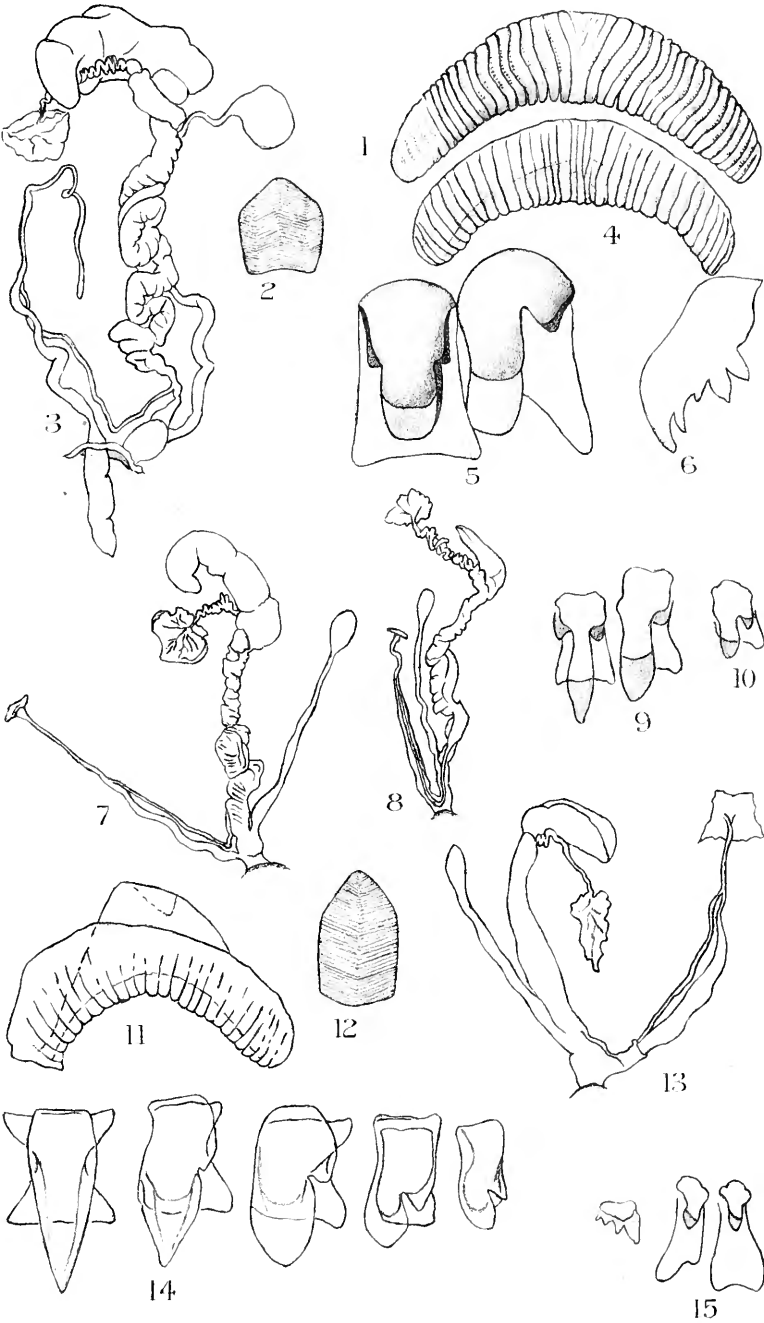






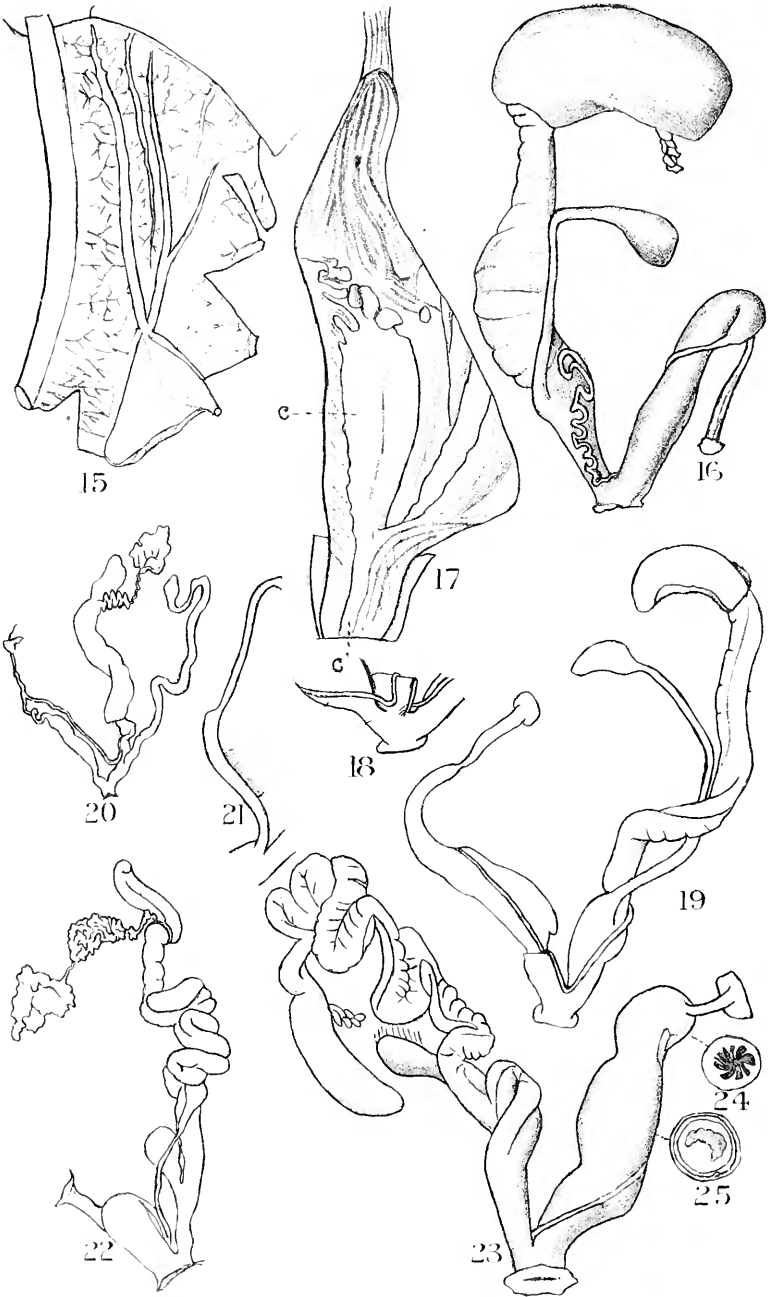




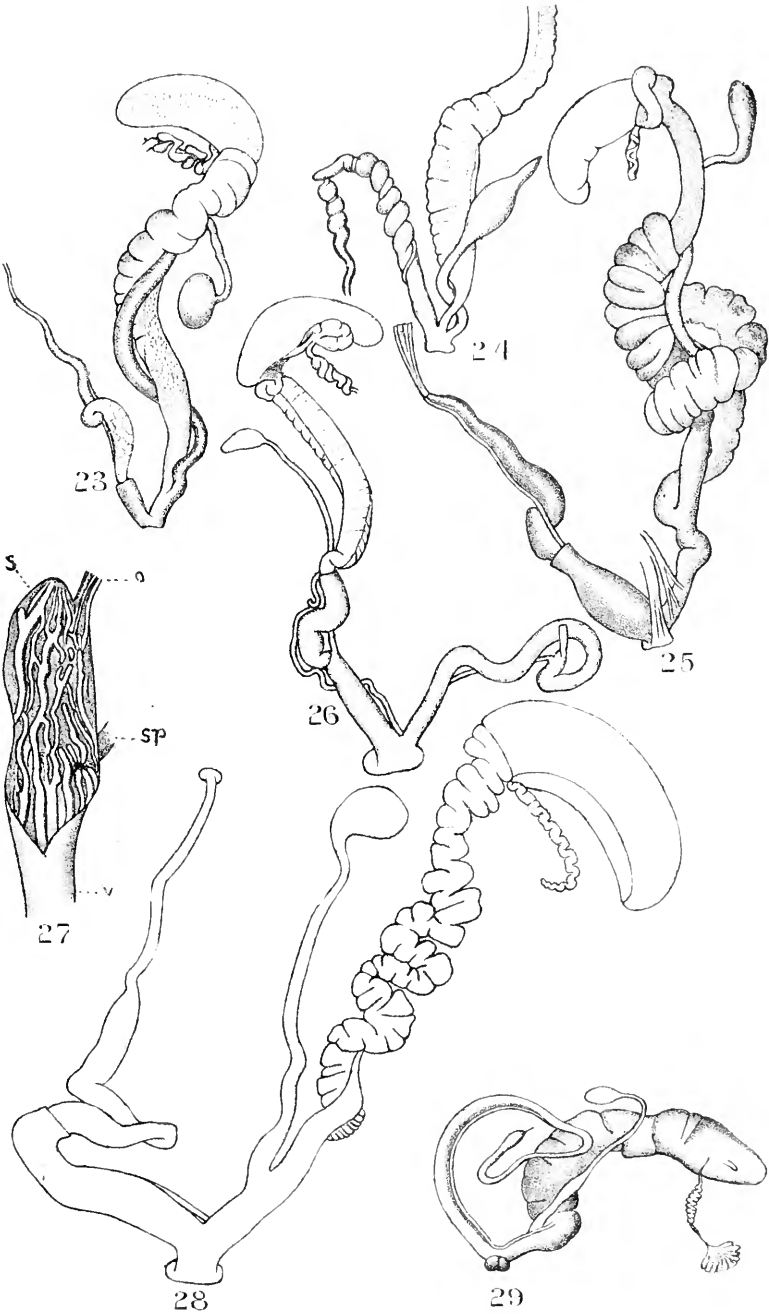




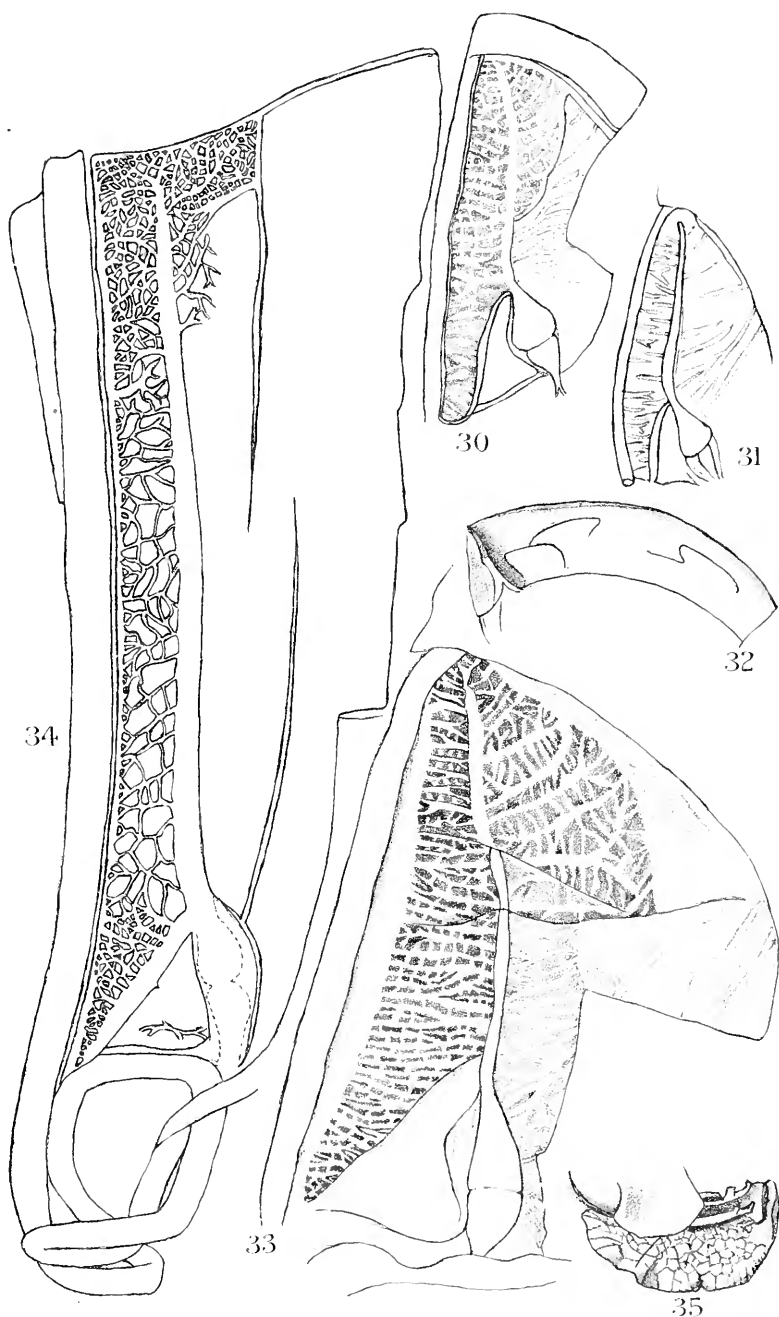




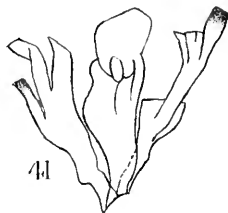
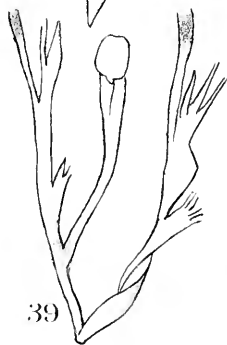
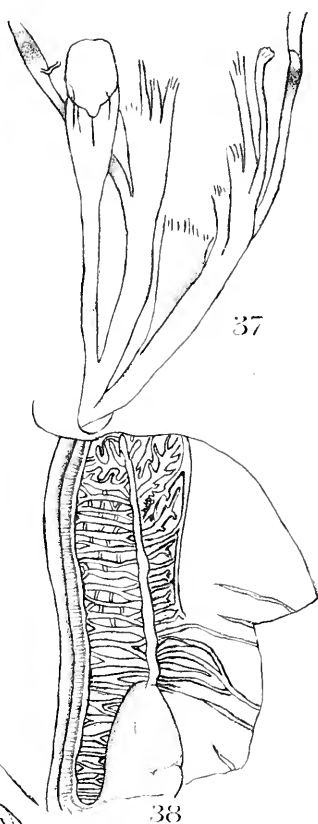






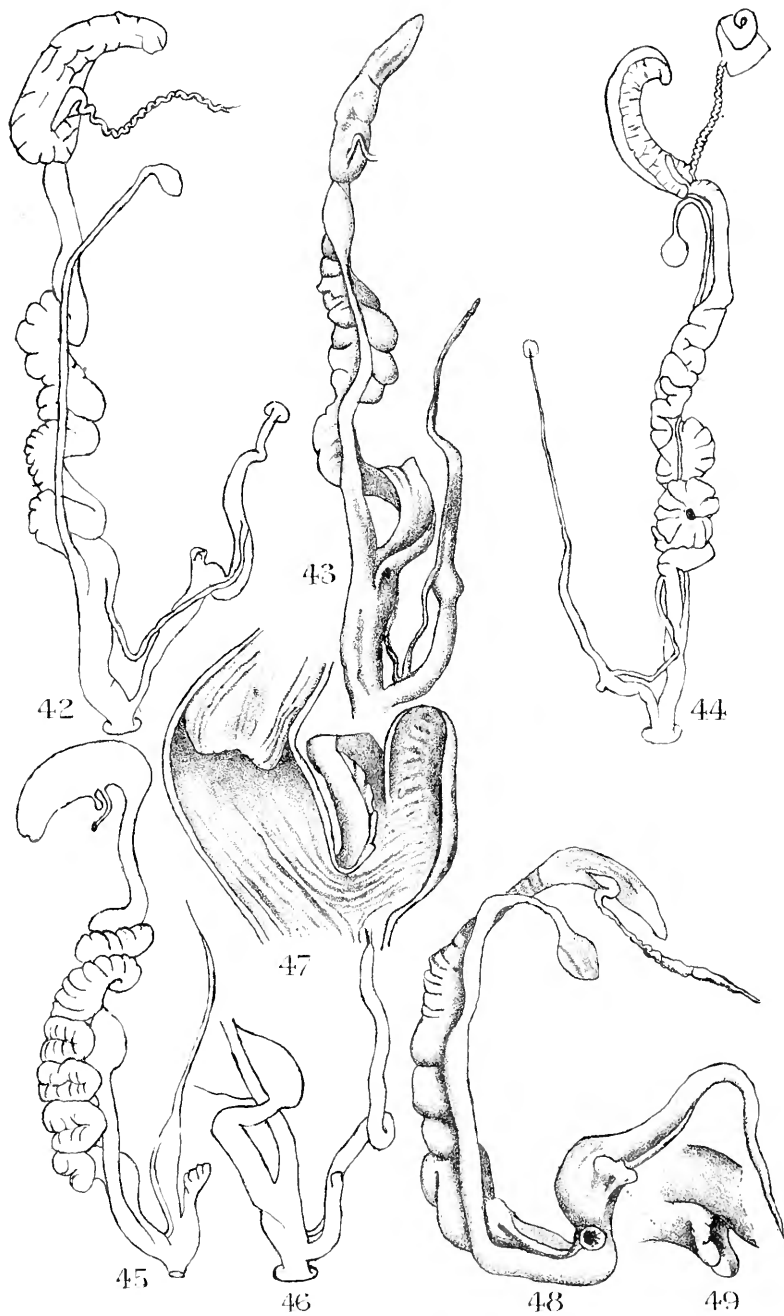




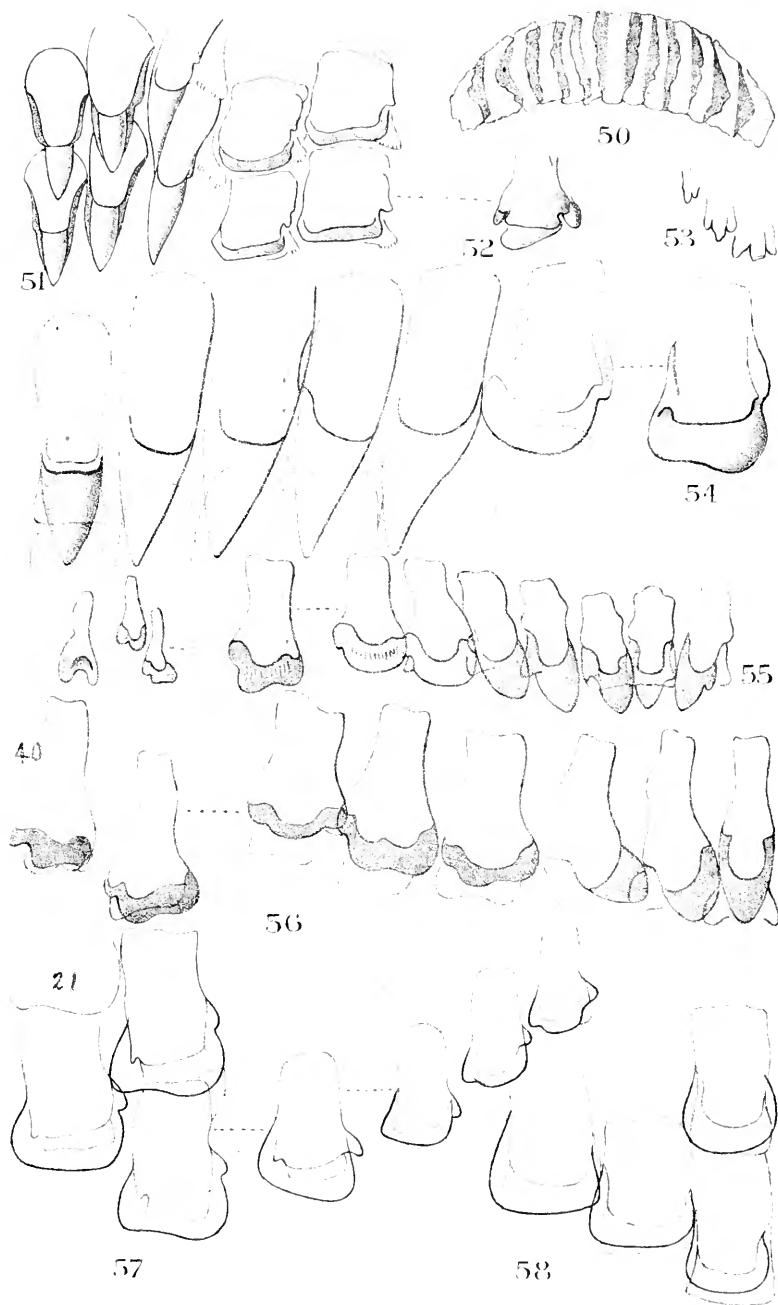








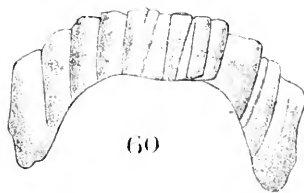








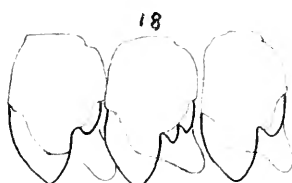
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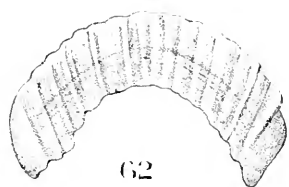


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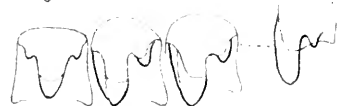
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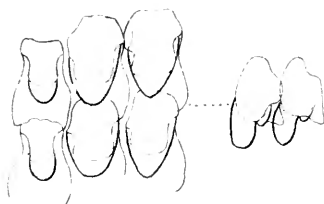
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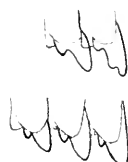
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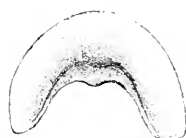
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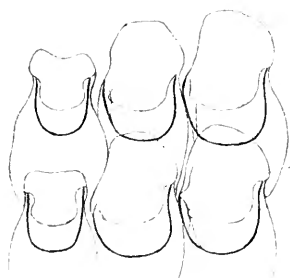
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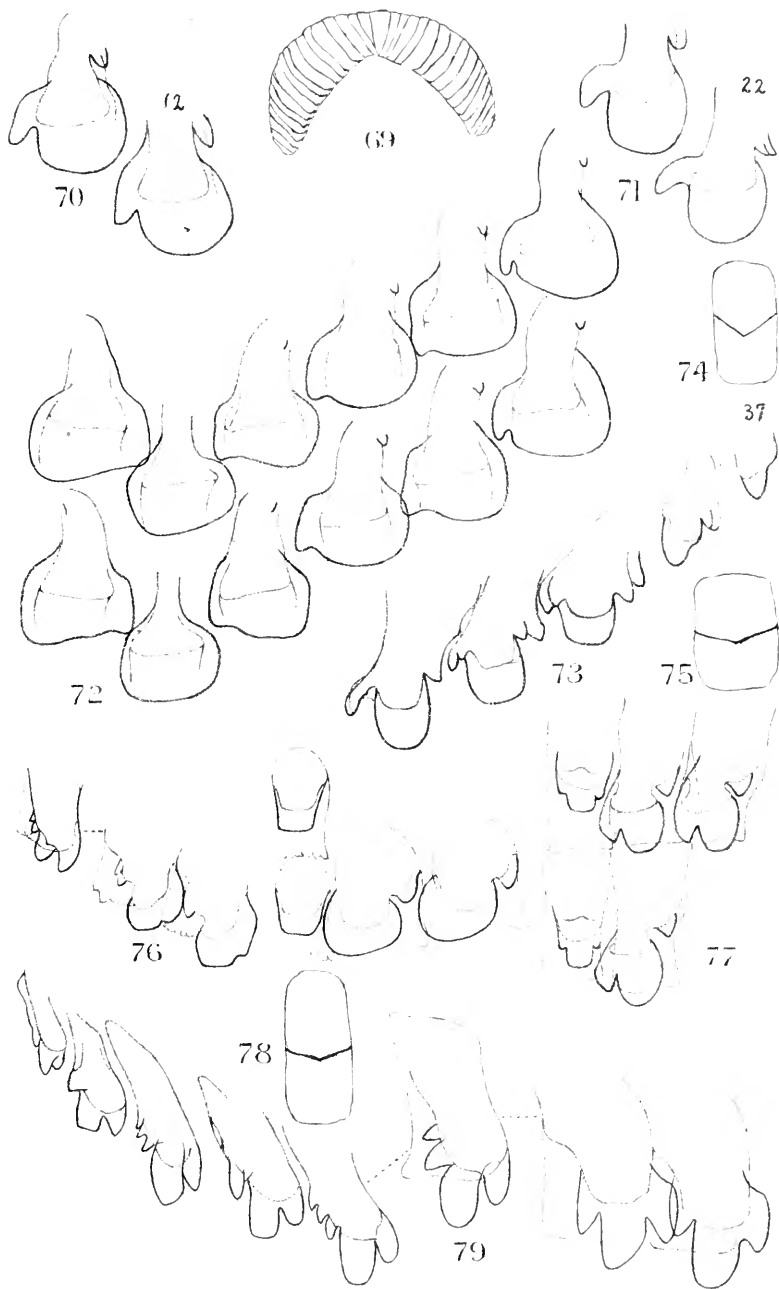


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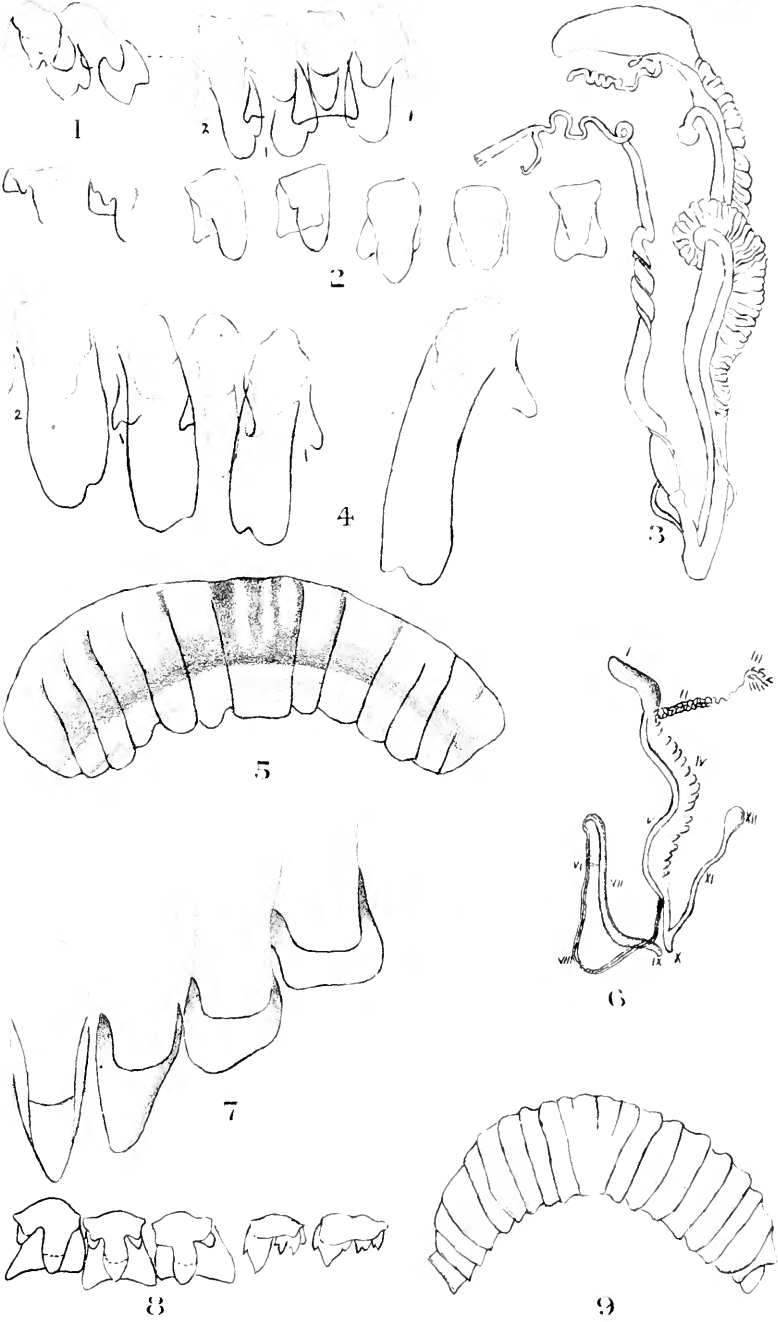
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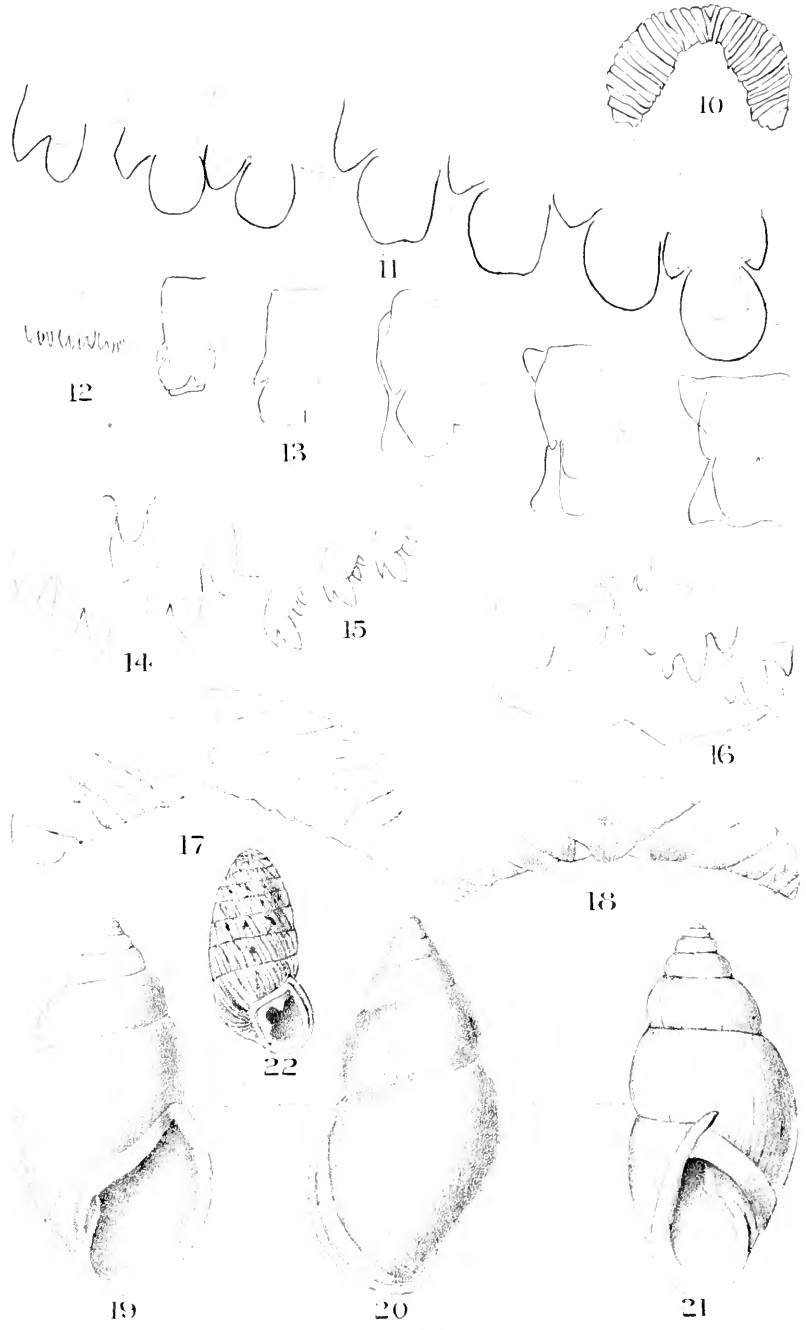














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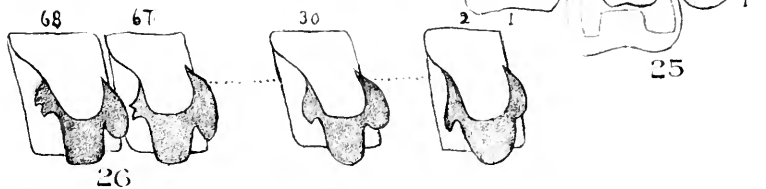
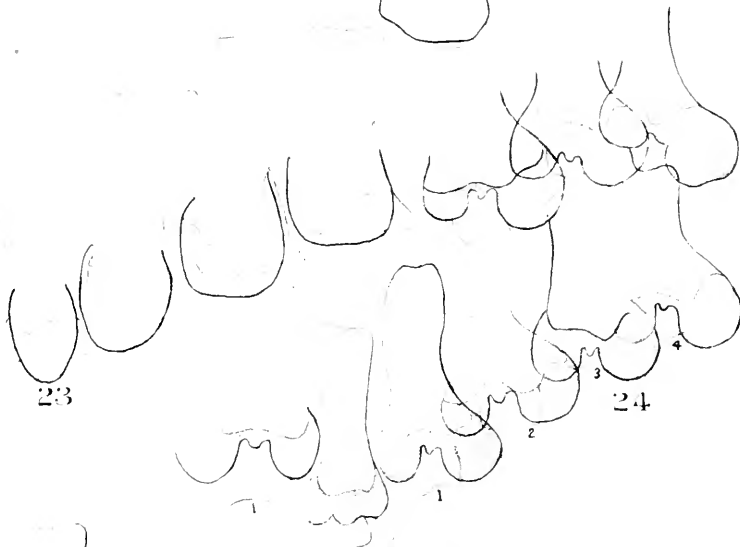
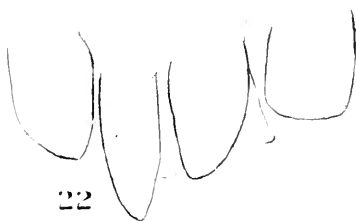
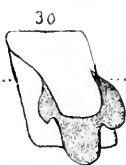
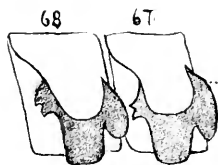
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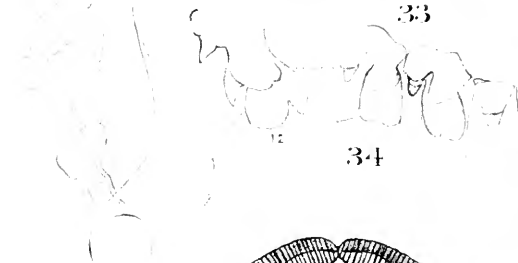
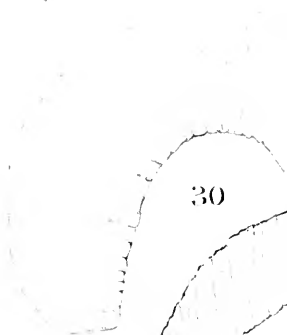
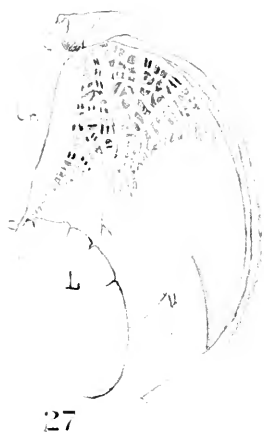
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SECOND SERIES: PULMONATA.

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MANUAL  
OF  
CONCHOLOGY

STRUCTURAL AND SYSTEMATIC.

---

WITH ILLUSTRATIONS OF THE SPECIES.

---

FOUNDED BY

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NATURAL SCIENCES OF PHILADELPHIA.

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CLASSIFICATION OF BULIMULIDÆ AND INDEX TO VOLUMES  
X, XI, XII, XIII AND XIV.

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PHILADELPHIA:

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This part contains a classification of the Bulimoid snails described in volumes x, xi, xii, xiii and xiv, with an Index to genera and species. It may either be bound with vol. xiv, or as a separate index volume.

All references herein to figures of the anatomy of Bulimi, refer to the plates of vol. xiv.

## INTRODUCTION.

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Owing in part to the absence of anatomical data, in part to the want of sufficient knowledge to interpret the facts in our possession, a number of groups belonging to the *Helicidæ* were formerly referred to the *Bulimulidæ* or "*Bulimidæ*," by reason of the lengthened and Bulimoid contour of their shells. Investigations made during the progress of the monographs on Bulimi have shown the true relationships of several of these genera.

### Family ZONITIDÆ.

Genus CALYCIA H. AD. xiv, p. 20.

The following genera are to be added to the *Helicidæ* enumerated in vol. ix of this series.

### Family HELICIDÆ (*sensu Pils.*)

#### Subfamily CAMÆNINÆ (*Epiphallogona*).

Genus AMPHIDROMUS Albers, 1850.

Man. Conch. xiii, p. 127; xiv, pp. 167, 282. A Bulimoid group of arboreal snails, extending from Indo-China to Timor.

Section *Syndromus* Pils., vol. xiii, p. 184. Same geographic range.

Subgenus BEDDOMEA Nevill, xiv, p. 1. Southern India and Ceylon.

Subgenus PSEUDOPARTULA Pfr., xiv, p. 9. Java, Sumatra and Borneo.

Genus DRAPARNAUDIA Montr. 1859.

Man. Conch. xiv, p. 12. New Caledonia and New Hebrides.

#### Subfamily HELICINÆ (*Belogona*).

(*Belogona Euadenia*.)

Genus EULOTA Hartm. (Vol. ix, p. 200).

Subgenus DOLICHEULOTA Pils., vol. xiv, p. 18. Formosa.

(*Belogona Siphonadenia*.)

(iii)

## Genus CYLINDRUS Fitz.

## Family ACAVIDÆ Pilsbry.

*Macroogona* Pils., Man. Conch. ix. Additional species are described in xiii, pp. 122-126.

## Subfamily STROPHOCHILINÆ.

This group differs from the *Bulimulidæ* by the long kidney, absence of a tubular ureter, copious venation of the cardiac side of the lung; the solid, smooth jaw, etc., etc. Suitable description and illustration of the soft anatomy of the group would occupy undue space in the Manual, and will be given elsewhere; but as *Gonyostomus* has been associated hitherto with *Bulimulinæ* it has been thought best to include some account of its anatomy here, in order to fix the position of the group.

Two genera of this subfamily are known, *Strophocheilus* and *Gonyostomus*.

## Genus STROPHOCHEILUS Spix.

Man. Conch. x, p. 1. The genus as constituted in vol. x requires some restriction, the group *Thaumastus* proving by its soft anatomy to belong to the family *Bulimulidæ*.

## Subgenus STROPHOCHEILUS s. str.

- |                                 |                                      |
|---------------------------------|--------------------------------------|
| S. pudicus Müll., xiv, p. 116.  | S. calus Pils., xiv, 119.            |
| <i>almeida</i> Spix.            | S. unidentatus Sowb., x, 9.          |
| S. planidens Mich., x, 7.       | S. erythrosoma Pils., x, 10; xiv.    |
| S. rhodocheilus Rve., x, 8.     | 117.                                 |
| S. pilsbryi v. Iher., xiv, 118. | <i>pudicus</i> Pfr.                  |
| S. milleri Sowb., x, 8.         | S. (?) contortuplicatus Rve., x, 71. |
| v. kronei Iher., xiv, 118.      |                                      |
| v. iguapensis Pils., xiv, 119.  |                                      |

## Subgenus BORUS Alb., 1850.

Man. Conch. x. pp. 10, 194; xiv, p. 120. Distribution, tropical and temperate South America.

- |                               |                             |
|-------------------------------|-----------------------------|
| S. popelairianus Nyst, x, 13. | S. maximus Sowb., x, 15.    |
| v. thammianus Mart., x, 14.   | v. kremnoicus Orb., x, 16.  |
| v. dohrnbianus Mart., x, 14.  | S. huascari Tschudi, x, 16. |
| v. connectens Mart., x, 14.   |                             |

- S. santacruzii* Orb., x, 16.  
*santacruzensis* Pfr.  
*sanctæ crucis* Beck.  
*S. lacunosus* Orb., x, 17.  
*S. mathiusii* Orb., x, 17.  
*matthewsii* Beck.  
*leucostoma* Sowb.  
*mahogani* Sowb.  
*S. durfeldti* Dohrn, x, 18.  
*S. hupeanus* Morel., x, 19.  
*castelnavi* Hupé.  
*S. cacopatensis* Pfr., x, 20.  
*S. granulosis* Rang, x, 20.  
*S. yporanganus* Iher. & Pils., xiv, 120.  
*S. valenciennesi* Pfr., x, 21.  
*fulguratus* Val.  
*S. cantagallanus* Rang, x, 22.  
*acceleratus* Mart.  
*proximus* Sowb.  
*terrestris* Spix.  
*corrugatus* Wagn.  
v. *intercedens* Mart., x, 22.  
*S. gummatos* Hid., x, 23.  
*S. ovatus* Müll., x, 24.  
*hæmastomus* Spix.  
*ovum* Ads.  
*Helix ovalis* Mawe.  
*Lymnæa imperialis* Lea.  
v. *chionostomus* Mörch, x, 25.  
*S. grandis* Mart., x, 26; xiv, 122.  
*S. iheringi* Cless., x, 196; xiv, 122.  
*proclivis* Mart., x, 195.  
*S. auritus* Sowb., x, 26; xiv, 121.  
*S. oosomus* Pils., x, 27.  
*S. fragilior* Iher., xiv, 121.  
*S. bromi* Pfr., x, 28.  
*browni* H. & A. Ads.  
v. *pergranulatus* Pils., xiv, 120.  
*S. paranaguensis* Pils. & Iher., xiv, 124.  
*S. oblongus* Müll., x, 29; xiv, 122.  
*Turbo hæmastomus* Gmel.  
*Helix ovipara* Portl. Catal.  
*B. roseus* Montf.  
*Helix semilineata* Mke.  
*Melania carnatis* Perry.  
v. *crassus* Alb., x, 30.  
v. *albolabiatus* Smith, x, 197.  
*tobagoensis* Pils., x, 30.  
*albus* W. G. B., xiv, 123.  
v. *alba* Smith, x, 197.  
*S. sanctipauli* Iher. & Pils., xiv, 123.  
*sanctæpauli olim.*  
*S. capillaceus* Pfr., x, 31.  
v. *seneri* Jouss., x, 31.  
v. *intertextus* Pils., x, 32; xiv, 123.  
*S. lorenzianus* Doer., xiv, 125.  
*S. lichtensteini* Alb., x, 32.  
*S. rosaceus* King, x, 33.  
*S. crenulatus* Pfr., x, 33.  
*Bulinus chilensis* Sowb.  
*B. credulatus* Nev., xiv, 126.  
*B. squamulatus* C. & J. (?)  
*S. crenellus* Phil., x, 34.  
*S. pachychilus* Pfr., x, 35.  
*S. bridgesi* Pfr., x, 35.  
*S. lutescens* King, x, 36.  
*nucleus* Sowb.  
v. *australis* Mart., x, 36.  
*dorbignyi* Doer., xiv, 126.  
v. *cordilleræ* Doer., xiv, 125.  
*S. globosus* Mart., x, 37; xiv, 124.

Subgenus *DRYPTUS* Alb., 1860.

Man. Conch. x, p. 37. Distribution, Venezuela and Colombia. The systematic position of this group cannot be regarded as fully settled.

- |                                      |                                      |
|--------------------------------------|--------------------------------------|
| <i>S. moritzianus</i> Pfr., x, 38.   | <i>S. marmoratus</i> Dkr., x, 40.    |
| <i>v. wilsoni</i> Pils., x, 39.      | <i>S. venezuelensis</i> Nyst, x, 41. |
| <i>S. indentatus</i> DaC., xiv, 281. | <i>S. stubeli</i> Mart., x, 42.      |
| <i>S. guerini</i> Pfr., x, 39.       | <i>S. funcki</i> Nyst, x, 42.        |
| <i>S. pardalis</i> Fér., x, 39.      | <i>superbus</i> Jonas.               |
| <i>leptochilus</i> Pfr.              | <i>adoptus</i> Rve.                  |
| <i>astropoides</i> Jonas.            |                                      |

Genus *GONYOSTOMUS* Beck, 1837.

Man. Conch. x, pp. 96, 121.

Shell rimate-umbilicate, fusiform or ovate-conic, rather thin, composed of 5 to  $5\frac{1}{2}$  gently convex whorls. Surface finely granose in spiral series. Aperture elliptic or ovate, angular above, rounded or angular below; the peristome evenly, narrowly expanded or reflexed. Outer lip regularly arcuate, without callous projections within. Columellar lip free, inserted high, the columella with a weak, deeply placed fold.

The foot (pl. 53, fig. 35, *G. multicolor*) is coarsely reticulated, the tubercles being large and polygonal at the sides much smaller on the dorsal surface of body and tail, three black stripes run parallel on the back, parted by two slightly wider reddish bands which terminate at the tentacles. The sole shows no trace of longitudinal division.

Kidney much longer than the pericardium, projecting backward. Ureter and secondary ureter open throughout, but represented by a distinctly differentiated band. Reticulation of the lung almost evenly spreading over both intestinal and cardiac sides, the vena cava and pericardial vein each supplied with several large branches (pl. 49, fig. 8, *G. multicolor*, x 2).

Free retractor system as in *Bulimulidæ*, the pharyngeal retractor being shortly connected with the left tentacular band, and the columellar muscle or tail retractor with the right band (pl. 54, fig. 37, *G. turnix*, x 2).

Genitalia (Pl. 51, fig. 16, *G. turnix*, x 2; pl. 52, fig. 26, *G. multicolor*, x 2; fig. 27, vagina of same), much as in *Stroph-ocheilus*. The penis is long, cylindrical and fleshy, bearing the

vas deferens and retractor at its summit. The vagina is long, and continued in a sort of pouch above the entrance of the spermatheca duct (pl. 52, fig. 27). The latter is slender and nearly as long as the oviduct. The ovisperm duct is imbedded in the concave side of the albumen gland nearly to the distal end of the latter.

The intestinal tract is of the usual four-folded type. The jaw is strong, arcuate, solid and smooth, with a slight median projection (pl. 57, fig. 59, *G. turnix*), or highly arched with a strong projection (pl. 57, fig. 67, *G. multicolor*). The radula has the formula 39.1.39 in *G. turnix* (pl. 57, fig. 68). The central and lateral teeth bearing single, broadly rounded cusps. The change to marginal teeth begins about at the 15th tooth, a division of the cusp into mesocone and ectocone gradually ensuing. A few extreme marginals are irregular in shape, as usual. In *G. multicolor* (pl. 57, figs. 65, 66) the formula is about the same, but the cusps are longer and less broadly rounded.

Type *G. gonyostoma*. Distribution, southern Brazil.

This genus was formerly considered a subgenus of *Bulimulidæ* subordinate to *Auris*. The examination of alcoholic specimens of two species, received from Dr. H. von Ihering, shows that it has no affinity to *Auris* or other Bulimuline genera, but is a member of the *Strophochilinæ*, closely related to *Strophocheilus*, from which it differs chiefly in the form of the shell. The form of the kidney, absence of any tubular ureter, the pattern of the lung, the solid jaw, unicuspid, median teeth of the radula, in fact the whole anatomy, is *Strophocheiline*, and widely different from the *Bulimuloid* genera.

My former treatment of this group is an instructive commentary on the inconclusive nature of purely shell characters. Before I had dissected *Gonyostomus* I thought it a member of the *Bulimulidæ*, while *Thaumastus* I took to be a subgenus of *Strophocheilus*; whereas the anatomy conclusively shows that *Gonyostomus* belongs to the *Strophochilinæ*, and *Thaumastus* is a typical member of the *Bulimulinæ*. And in dealing with both genera I had before me specimens of the shells of nearly every species for study.

The genitalia of *Gonyostomus* present some interesting features. The vas deferens in *G. turnix* adheres to the vagina, upon which it pursues a sinuous course (pl. 51, f. 16). The vagina is plicate within (pl. 52, fig. 27, *G. multicolor*, *v*, vagina; *sp*, lower end of the spermatheca duct; *o*, lower end of the oviduct; *s*, accessory sac).

It continues upward beyond the entrance of the spermatheca, terminating in a short blind sac. This sac is homologous with the accessory sac at the base of the spermatheca in *Strophocheilus*, and perhaps with the appendiculum of *Panda* and *Pedinogyra*. The lower portion of the ovi-sperm duct is imbedded in the albumen gland as in *Ampelita*. There is no sheath about the base of the penis in *G. turnix*. The lumen of the penis is large, longitudinally plicate, the folds crenulate. No papilla.

In *G. multicolor* the lung is black-pigmented except posteriorly. The spermatheca lies near the inner end of the pericardium.

*G. goniostoma* Fér., x, 122.

*G. turnix* Gld., xvi, 133.

*G. erubescens* Swains.

*G. multicolor* Rang, x, 123.

*G. hybrida* Gld., x, 123.

*G. miersii* Sowb., x, 124.

*B. egregius* Pfr.

#### Family BULIMULIDÆ.

Shell usually oblong or ovate, rarely columnar, helicoid or partially degenerate and Succinea-like. *Kidney triangular, as short as the pericardium*, with a reflexed ureter, and closed or rarely open secondary or gut ureter. Lung having a *long unbranched pulmonary vein*, the first branch of the pericardial vein sometimes well-developed, a branch of the vena cava lying between them; *the reticulation chiefly confined to the region near the pneumostome* between the last-named branch and the rectum, *and the tract between the pulmonary vein and the last fold of the gut*. *Jaw made up of vertical or converging plates* conerescent except at their outer and usually imbricating margins (rarely completely united, and smooth). Radula of the ordinary Helicid type or variously specialized. Intestine of the usual four-folded type. In the free retractor muscle system the right ocular band arises from the face of the columellar muscle and the left ocular band is united for a greater or less distance with the pharyngeal retractor muscle.

While related to the *Helicidæ*, snails of this family are well characterized by the triangular kidney, not exceeding the pericardium in length. The jaw, lung and shell are also to a less extent characteristic. The *Acavidæ* and especially the *Strophochilinæ* are likewise allied to *Bulimulidæ*, but in these groups the kidney is oblong, prolonged backward, the ureter is imperfect or wanting, the jaw solid, the pattern of lung venation diverse, and the nepionic shell larger.

Those *Helicidæ* having a Bulimoid shell, such as *Amphidromus*,



*Draparnaudia*, *Helicostyla*, etc., differ from all *Bulimulidæ* in important features of the pallial organs, genitalia, etc. The same is true of the *Partulidæ* and *Buliminidæ*, groups closely imitating *Bulimulidæ* in the form of the shell.

All the subfamilies and a large majority of the genera are South American. Two genera, *Bulinulus* and *Drymæus*, belonging to the most primitive subfamily of the group, *Bulimulinæ*, extend into the West Indies and North America; and two others, *Bothriembryon* and *Placostylus*, occur in Australasia, giving testimony to the former existence of an Antarctic land connecting the austral continents of the two hemispheres. The other subfamilies are more specialized, and confined to middle and South America. All *Odontostominæ* are South American. The *Orthulicinæ* inhabit tropical South America, with two genera, *Oxystyla* and *Liguus*, in the Antilles, Mexico and Southern Florida. The subfamily *Amphibuliminæ* has the same distribution, two genera being Antillean and Mexican, two South American.

The past history of the *Bulimulidæ* is still most obscure. The numerous modifications of the group, and its omnipresence in South America lead us to believe it an old group there, and probably it arose in that region. Its advent in continental North America has obviously been a recent incursion from the South, and the Australasian groups also are emigrants from South America. But while its chief characteristics must have been well established in Cretaceous or Jurassic times, there is yet no trace of *Bulimulidæ* in Africa. This is somewhat remarkable because a former land connection with Africa through the mid-Atlantic, as claimed by Koken and others, is emphatically proclaimed by the *Streptaxidæ*, *Achatinidæ* (*Neobeliscus*, etc.), *Ampullariidæ*, freshwater fishes, etc., of South America. This is altogether independent of the problematic connection of South Africa and Antarctica, claimed by certain naturalists, and supported to some extent by the dominance of *Eudodontidæ* of Austral types in the Cape region and St. Helena.

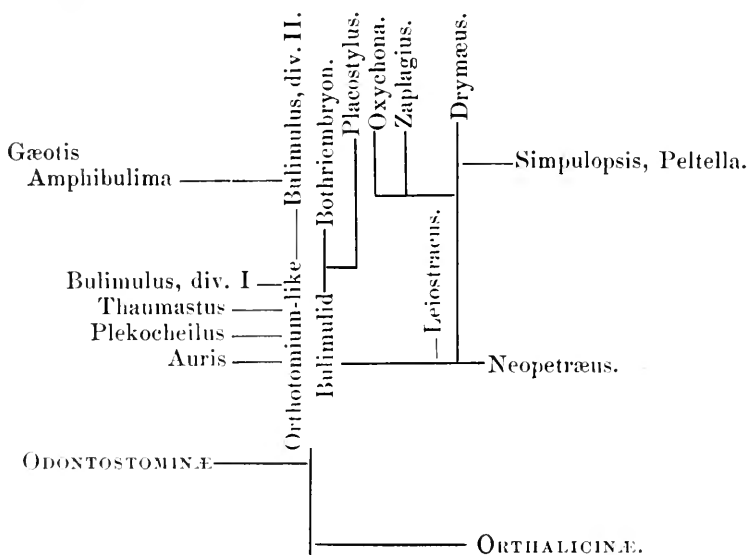
#### *Classification of Bulimulidæ.*

The family may be divided into four subfamilies, as follows:

- I. BULIMULINÆ. Shell usually perforate or umbilicate, usually ovate, rarely cylindrical or Helicoid; generally rather small, the aperture toothless. Jaw with vertical or converging plaits. Teeth of the normal Helicid type or variously modified. Genitalia without accessory organs.

- II. ODONTOSTOMINÆ. Shell varying from fusiform to Helicoid. Aperture usually obstructed by internal lamellæ, folds or teeth. Jaw plaited or solid. Dentition Helicid. Genitalia simple.
- III. ORTHALICINÆ. Shell ovate-conic or oblong, imperforate, with solid axis, usually rather large and strikingly colored, the aperture toothless, sometimes with a columellar fold. Jaw strong, with rather few, wide plaits. Teeth in V shaped rows, bearing single broad, gouge-shaped cusps, the median teeth sometimes lance-shaped. Penis provided with an accessory gland or appendix.
- IV. AMPHIBULIMINÆ. Shell more or less degenerate, globose, oblong, *Succinea*-shaped or *Haliotis* shaped, always thin and mainly cuticular. Jaw very delicate and highly arched, composed of many close, converging plaits. Radula variously specialized, the cusps large. Genitalia simple.

With the exception of the last subfamily, these groups seem to be natural. The main lines of generic affinity, and approximate phylogeny, may then be represented by the accompanying diagram. The relationships of the genera of *Orthalicinæ* to one another have been considered elsewhere (vol. xii, p. 100), those of the genera of *Odontostominæ* in this volume.



*Artificial key to genera of Bulimulidæ, by shell characters.*

The *Amphibulimæ* (see above) are not included in this key.

*Shell Helicoid or trochiform, capable of standing more or less upright upon the base.*

*a.* Aperture conspicuously contracted by teeth or folds.

*b.* Aperture turning upward ; shell biconvex, mottled.

*Anostoma*, xiv, 109.

*b*<sup>1</sup>. Aperture oblique, shell transversely oval or trochiform.

*Tomigerus*, xiv, 105.

*a*<sup>1</sup>. Aperture toothless.

*b.* Apical whorls most minutely, evenly grated (as in pl. 15, f. 31); not umbilicate.

*c.* Last whorl distorted ; basal lip advanced.

*Zuplagius*, xi, 185.

*c*<sup>1</sup>. Last whorl normal; shell trochiform. *Orychona*, xi, 181.

*b*<sup>1</sup>. Apical whorls not so sculptured ; shell earthy, dull and opaque, openly umbilicate.

*c.* Aperture angular, oblique, the lip simple, discontinuous.

*Platybostryx*, x, 129.

*c*<sup>1</sup>. Aperture subhorizontal, the lip flaring, continuous.

*Xenothauma*, xiv, 134.

*Shell ovate, oblong or pillar-shaped, "Bulinoid."*

*a.* Apical whorls smooth.

*b.* Lip reflexed, often conspicuously thickened ; shell usually solid and rather large.

*c.* Aperture angular below, or with sinuous lip ; or the lip bears a callous flange.

*Auris*, x, 95.

*c*<sup>1</sup>. Aperture broadly rounded below, *Plekocheilus*, x, 62.

*Porphyrobaphe*, xii, 149.

*b*<sup>1</sup>. Lip reflexed ; aperture oblong with *parallel* margins ; size small.

*Auctus*, xiv, 36.

*b*<sup>2</sup>. Lip acute, not at all expanded ; shell rather large, wholly imperforate, the columellar lip completely adnate ; often conspicuously colored. *Oxystyla*, xii, 101. *Lignus*, xii, 160.

*b*<sup>3</sup>. Lip acute and simple or expanded ; shells of moderate or small size, usually perforate or rimate. *Bulimulus*, division I, x, 127. *Neopetræus*, in part, xi, 163. *Leiostracus*, xii, 90.

- a*<sup>1</sup>. Apical whorls most minutely, evenly cancellate, as in pl. 15, fig. 31, neither spiral nor vertical sculpture predominating; or in other words, with minute pits in spiral and straight vertical series.
- b*. Shell strong, the peristome thick, with strong callous flanges within lip and columella; spire short. *Otostomus*, x, 107.
- b*<sup>1</sup>. Shell elongate, the aperture having teeth, or angular below.  
*Odontostomus*, xiv, 38.
- b*<sup>2</sup>. Aperture without teeth or folds; shell rather thin.
- c*. Base obliquely truncate. *Zaplagius*, xi, 185.
- c*<sup>1</sup>. Base tapering, rarely angular; lip varying from unexpanded to reflexed. *Drymæus*, xi, 191.
- a*<sup>2</sup>. Apical whorls with straight vertical riblets.
- b*. Aperture provided with teeth or folds.  
*Odontostomus*, in part, xiv, p. 38.
- b*<sup>1</sup>. Aperture ovate, without teeth.
- c*. Intervals between the apical riblets conspicuously striate spirally. *Neopetraeus*, xi, 163.
- c*<sup>1</sup>. Intervals smooth or weakly striate spirally. *Bulimulus*, division III, xi, 83; and *Bothriembryon*, in part, xiii, p. 1.
- a*<sup>3</sup>. Apical whorls sculptured with waved, irregular or dislocated wrinkles, sometimes forming a net or mesh pattern, or pitted in the pattern of a thimble.
- b*. Aperture with several pliciform teeth or folds.  
*Odontostomus*, in part, xiv, p. 93.
- b*<sup>1</sup>. Aperture with obtuse teeth, or a callus on the parietal wall defining a posterior groove; whorls  $4\frac{1}{2}$  to  $5\frac{1}{2}$ .  
*Hyperaulax*, xiv, p. 102.
- b*<sup>2</sup>. Aperture ovate, without teeth or posterior groove.
- c*. American genera.
- d*. Wholly imperforate, large, elaborately variegated, apex conspicuously thimble-pitted.  
*Orthalicus*, xii, 186.
- d*<sup>1</sup>. Usually rimate or umbilicate; rather large, brown or marked with brown.
- e*. Shell dappled or zigzag-streaked.  
*Plekocheilus*, x, 62.
- e*<sup>1</sup>. Shell streaked, banded or unicolored.  
*Thaumastus*, x, 43.

*d*<sup>2</sup>. Perforate, rimate or umbilicate, smaller; plain, streaked or banded.

*Bulimulus*, division II, xi, p. 1.

*c*<sup>1</sup>. Australasian genera.

*d*. Auriculoid, the lip thickened, expanded or reflexed. *Placostylus*, xiii, 19.

*d*<sup>1</sup>. *Bulimulus*-like, the lip simple.

*Bothriembryon*, xiii, 1.

*a*<sup>4</sup>. Apical whorls spirally striate; aperture toothed.

*Macrodonates*, xiv, 29.

#### Subfamily I. BULIMULINÆ.

The numerous genera of this subfamily may be classified provisionally thus:—

1. *Radula with teeth of the normal or unspecialized Helicid type.*

(American genera.)

*a*. Shell rather large, ovate or oblong.

*b*. Lip conspicuously calloused or with a callous flange, or having the aperture distorted. *Auris*.

*b*<sup>1</sup>. Aperture ovate, the lip without calluses.

*c*. Ovate, the shell dappled, maculate or zigzag striped, *Plekocheilus*.

*c*<sup>1</sup>. Oblong, streaked or with a few wide bands; nepionic shell rather large and sculptured. *Thaumastus*.

*a*<sup>1</sup>. Shell much depressed, with crater-like umbilicus, subhorizontal aperture and continuous flaring peristome. *Xenothauma*.

*a*<sup>2</sup>. Shell *ovate*, pillar-shaped or *Helicoid*, plain, banded or streaked, the aperture with simple or expanded peristome. *Bulimulus*.

(Australasian genera.)

*a*. Shell rather thin, *Bulimulus*-like, the peristome simple. Duct of the spermatheca long. *Bothriembryon*.

*a*. Shell auriculoid, the peristome reflexed or expanded, generally much thickened and bright colored. Duct of the spermatheca short. *Placostylus*.

2. *Radula with variously specialized teeth, unlike the ordinary Helicid type. Jaw very thin and flexible.* (All American.)

*a*. Shell ovate or oblong, usually with a peculiar color-pattern of oblique streaks; the apical whorls sculptured with vertical riblets and finer, lower, spiral striæ, sometimes smooth. Rows of teeth

only moderately curved, the teeth of the median portion of the radula having single, exceedingly long, oblique, blunt or emarginate cusps. *Neopetræus*.

*a*<sup>1</sup>. Apical whorls of the shell sculptured with an exceedingly fine, even grating, formed by minute pits regularly arranged in spiral and vertical series (as in pl. 15, fig. 31).

*b*. Periphery of shell angular, or base obliquely truncate or flattened; teeth of the median portion of radula having enormously expanded, rounded cusps (entococone and mesococone), and minute, spur-like, basal ectococones; the transverse rows V-shaped, running obliquely *backward* from the middle.

*c*. Shell trochiform, smooth, regular. Plaits of the jaw vertical and parallel. No entococone appearing on the teeth. *Oxychona*.

*c*<sup>1</sup>. Shell with conic spire, the last whorl running upward, or obliquely truncate below. Jaw high-arched, with narrow converging plaits. Entococone conspicuous on the outer lateral and marginal teeth. *Zaplagius*.

*b*<sup>1</sup>. Shell ovate or oblong. Teeth of the radula excessively numerous, with indistinct basal-plates, arranged in variously curved rows, but running obliquely *forward* on each side of the rhachis; all the lateral teeth of a peculiar tricuspid form.

*Drymæus*.

*a*<sup>2</sup>. Apex of shell nearly smooth, but usually showing some low irregular longitudinal wrinkles, and faint, fine, spiral striæ. Radula with comparatively few teeth in a transverse row, the rows running a little backward from the rhachis. Lateral teeth having a broad, rounded main cusp and a well-developed ectococone, the marginal teeth much as in *Drymæus*. *Leiostracus*.

#### Genus AURIS Spix.

Manual x, p. 95. Type *A. melastoma*. *Pachyotus* of many authors.

Large, usually pale-colored *Bulimulidæ*, with the apex smooth, the peristome reflexed and generally bearing a flange or callosity upon the outer lip.

The genital system, jaw and teeth, present no well-marked or diagnostic characters differentiating this group from *Plekocheilus* or *Bulimulus*. It rests upon conchologic peculiarities.

Subgenus AURIS *s. str.*

The anatomy of *A. bilabiata* and *A. egregia* has been examined by Semper. There is a rather broad and long mantle-lobe extending along the whole left mantle-edge. The kidney is short, hardly longer than the pericardium; secondary ureter closed. The venation of the lung is confined to the neighborhood of the pneumostome.

The genital system (pl. 50, fig. 13, *A. egregia*, after Semper) is simple, the penis with terminal retractor and no papilla. At its base there is a circular muscle, embracing also the vas deferens, as in many *Bulimulus*. The small spermatheca is borne upon a long duct.

The jaw of *bilabiata* is composed of 13 unequal, broad, flat ribs, hardly projecting below. In *egregia* there is a very wide, smooth-edged median plait, with two broad ribs on each side, not produced on the cutting edge.

The radula has 61–63 teeth in *bilabiata*, 65–67 in *egregia*, the transverse rows being slightly angular in the middle. The middle tooth is tricuspid, median cusp wide; the laterals have a small ectocone and obtuse mesocone.

The jaw in this group is in a transition state from the plaited to the smooth type. The genitalia and teeth offer no differences of importance from those of *Eudolichotis*.

- |  |  |
|--|--|
| <i>A. bilabiata</i> B. & S., x, 99.    | <i>A. icterostoma</i> Mart., xiv, 132. |
| <i>Helix maximiliana</i> Fér.          | <i>A. chrysostoma</i> Mor., x, 103.    |
| var. <i>melanostoma</i> Mor., x,       | var. <i>swainsoni</i> Pfr., x, 104.    |
| 101.                                   | <i>A. bernardii</i> Pfr., x, 105.      |
| <i>A. egregia</i> Jay, x, 101.         | <i>A. illheocola</i> Mor., x, 106.     |
| var. <i>nigrilabris</i> Pils., x, 102. |  |
| <i>A. melastoma</i> Sw., x, 102.       |  |
| <i>B. melanostomus</i> Dh.             |  |
| <i>B. struthiolaris</i> Mke.           |  |
| var. <i>brachyplax</i> Pils., x, 103.  |  |

## Subgenus (?) OTOSTOMUS Beck, 1837.

Manual, x, p. 107.

The apex in this group is exactly like that of *Drymaeus* and of the sections of *Odontostomus* grouping around the typical subgenus. Whether the group belongs to *Auris*, or is a distinct genus near the

*Zaplagius* group of *Drymaeus*, will depend upon the soft anatomy; but I think likely that an examination of the jaw and teeth will show the latter location to be near the truth.

*A. signata* Spix, x, 107.

Province of Bahia, Brazil.

*Auris vittata* Spix.

Subgenus *EUDOLICHOTIS* Pilsbry, 1896.

Man. Conch., x, pp. 98, 108. Type *A. distorta*.

The mantle of *A. distorta* has a very small anterior and two larger, widely separated left lobes. The kidney is even shorter than the pericardium. The genital system (pl. 50, fig. 7, after Semper) is simple, the long penis prolonged beyond the insertion of the vas deferens, with terminal retractor; duct of the spermatheca long.

The jaw of *A. distorta* has 35 plaits, the edges of which are hardly free; 5 or 6 median plaits converge and are coalescent, only the outer reaching the lower margin (*Semper*). That of *A. aurissciuri* (pl. 50, fig. 11, after Pace) is similar but with less converging and with fewer plaits. It is like the jaw of *Bulinulus*. The radula of *A. distorta* has 100-108 teeth in the slightly V-shaped rows. The median tooth has a long lanceolate cusp; first lateral tooth is similar with a small ectocone, the rest having more rounded cusps and larger ectocones (pl. 50, fig. 14, a central with 1st, 2d, 17th and 25th teeth, after *Semper*).

*A. distorta* Brug., x, 109.

var. *sublaevis* Pils., x, 111.

var. *gracilis* Pils., x, 111.

var. *guaiensis* Jouss., x, 111.

var. *bisuturalis* Pils., x, 112.

*A. aurissciuri* Gp., x, 112.

*B. aegotis* Pfr.

*A. glabra* Gm., x, 113.

*Voluta auris Judæ* Meusch.,  
xiv, 133.

*H. auris-caprinus* Fér.

*P. caprinus* Bk.

*Pupa auris silenii* Gray.

*Auricula silenii* Lam.

*A. glabra* Gmel.

*Pelek. undulatus* Bk.

*Bul. aegotis* Mke.

var. *grenadensis* Gp., x, 114.

*A. lacerta* Pfr., x, 115.

*A. sinuata* Alb., x, 116.

*A. euryomphala* Jon., x, 116.

*B. otostomus* Pfr.

*A. perdix* Pfr., x, 118.

*A. dillwyniana* Pfr., x, 118.

*A. midas* Alb., x, 119.

var. *spectrum* Alb., x, 119.

*A. hauxwelli* Crosse, x, 120.



## Genus PLEKOCHAILUS Guilding, 1828.

Man. Conch. x, p. 62.

Shell ovate, usually solid and opaque and zigzag-streaked or dappled with brown. Aperture large, ovate, the peristome expanded, reflexed or blunt, columella bearing a fold, or simple.

There are two small, well-separated frontal lobes on the left side of the mantle. Kidney (of *P. blainvillanus*) very short, triangular, not projecting beyond the pericardium.

Genitalia (*P. blainvillanus*, pl. 50, fig. 3, after Semper): Atrium very short; penis moderately long, continued in a long epiphallus which terminates in the vas deferens and a long flagellum; "retractor muscle inserted about the middle." Vagina short and wide. Spermatheca globular, on a very long duct, as long as the oviduct. (The penis is shown exerted in the figure). Jaw arcuate, composed of numerous delicate plaits, 41 in *P. blainvillanus* (pl. 50, fig. 4, after Schako), about 60 in *P. aulacostylus*.

Radula broad, the rows of teeth widely V shaped (pl. 50, fig. 12, *P. blainvillanus*), composed of 62,1,62 x 110 teeth (*blainvillanus*, pl. 50, figs. 5, 6). In this species the basal-plates are longer than the cusps; central tooth with a stout middle cusp, side cusps small; laterals similar but with no inner cusp; marginals irregularly denticulate. In *P. aurissileni* and *P. aulacostylus* (pl. 50, figs. 9, 10, after Binney) the mesocones are long and acute, reaching beyond the basal-plate; in the former the side-cusps are sub-obsolete, in the latter well developed.

Type, *P. aurissileni* (Born).

Distribution: Northwestern South America, St. Vincent and St. Lucia.

My knowledge of the soft anatomy of this genus is from the work of Semper, Binney and Schako. It agrees in all respects with *Bulimulus* except that Semper states that there is a flagellum on the penis. This seems to me very doubtful. The structure he figures may rather be the retractor muscle of the penis. The rank of *Plekocheilus* as a genus rests upon its conchological peculiarities.

Section *Plekocheilus* s. str.

Man. Conch., x, p. 64.

Shell wrinkled or malleate, the spire costulate.

- P. aurissileni* Born, x, 65.      *P. blainvillae* Pfr., x, 67.  
*Auricula caprella* Lam.      var. *loveni* Pfr., x, 67.  
*Carychium undulatum* Leach.      *P. lugubris* Dkr., x, 68.  
*Plekocheilus silenii* Beck.      *P. appuni* Dkr., x, 68.  
*P. fulminans* Nyst, x, 66.  
*Bulinus bellulus* Jonas.  
var. *linterae* Sowb., x, 67.

Section *Eurytus* Albers, 1850.

Man. Conch., x, p. 69. Type *P. pintadinus* (Orb.).  
Shell granose or striate, rarely almost smooth.

Group of *P. speciosus*.

- P. speciosus* Pfr., x, 70.      *P. guentheri* Sowb., xiv, 129.  
*P. plectostylus* Pfr., x, 70; xiv,      *B. guildingi* Dohrn, x, 71,  
129.      preoc.

Group of *P. aulacostylus*.

- P. aulacostylus* Pfr., x, 72. St. Lucia.  
*B. lentiginosus* Redf.

Group of *P. coloratus*.

- P. roseolabrum* Sm. x, 73.      *P. corticosus* Sowb., x, 76.  
*P. eros* Angas, x, 74.      *P. cardinalis* Pfr., x, 77.  
*P. coloratus* Nyst, x, 74, 198;      *P. tetensi* Dkr., x, 77.  
xiv, 129.      *P. couturesi* Anc., xiv, 131.  
var. *lamarekianus* Pfr., x, 75.      *P. pulicarius* Rve, x, 78.  
var. *ampullaroides* Mss., x,      *B. glandiformis*, Pfr.  
75.      *P. glandiformis* Lea, x, 78.  
var. *subplicatus* Pfr., xiv, 130.      *P. mabiliei* Crosse, x, 79; xiv, 127.  
*P. gibbouius* Lea, x, 75.      *P. subglandiformis* Mss., x, 80.  
*B. gibboreus*, Pfr.-Cless., xiv,      *P. corydon* Crosse, x, 80.  
127.      *P. phoebus* Pfr., x, 81.  
*P. doliarius* DaC., xiv, 130.      *P. taquinensis* Pfr., x, 81.  
*P. episcopalis* Pfr., x, 76.

*Group of P. succinoides.*

- |                                |                                       |
|--------------------------------|---------------------------------------|
| P. cathartiae Rve., x, 82.     | P. succinoides Pet., x, 84; xiv, 128. |
| P. (?) victor Pfr., x, 82.     | <i>B. succineoides</i> Mart.          |
| P. jucundus Pfr., x, 82.       | <i>Succinea bulimoides</i> Pfr.       |
| P. quadricolor Pfr., x, 83.    | <i>B. latilabris</i> Pfr.             |
| P. dalmasi Dantz., xiv, 128.   | P. calliostoma Dohrn, x, 85.          |
| P. argenteus Jouss., xiv, 128. |                                       |
| P. veranyi Pfr., x, 83.        |                                       |
| var. scytodes Pfr., x, 84.     |                                       |
| <i>scytodes</i> Ads., x, 199.  |                                       |

*Group of P. castaneus.*

- |                                     |                                |
|-------------------------------------|--------------------------------|
| P. castaneus Pfr., x, 85; xiv, 131. | P. jimenezi Hid., x, 86, 199.  |
| P. elaeodes Pfr., x, 86.            | <i>B. gibbonius</i> Hid. olim. |
| P. aristæus Crosse, x, 88, 199.     |                                |

*Group of P. taylorianus.*

- |                                       |   |
|---------------------------------------|---|
| P. piperitus Sowb., x, 89.            | P. superstriatus Sowb., x, 91.                  |
| <i>P. pulicarius</i> Bk., xiv, 132.   | var. prodeflexus Pils., x, 91.                  |
| P. piperatoides Pils., xiv, 132.      | P. aureonitens Mill., x, 91.                    |
| P. pseudopiperatus Mor., x, 89.       | P. tricolor Pfr., x, 87; xiv, 131.              |
| P. taylorianus Rve., x, 90; xiv, 132. | var. semipictus Hid., x, 87.                    |
|                                       | ? <i>Simpulopsis fulgurata</i> Mill., xii, 227. |
| <i>E. taylorioides</i> Mill.          |   |

*Group of P. floccosus.*

- |                               |                              |
|-------------------------------|------------------------------|
| P. floccosus Spix, x, 92.     | P. onca Orb., x, 93.         |
| P. lacrimosus Heimb., x, 199. | <i>B. onza</i> Alb.          |
| P. pintadinus Orb., x, 93.    | P. lynceulus D. & H., x, 94. |
| <i>Helix pentadina</i> Orb.   | P. semperi Dohrn, x, 94.     |

## Genus THAUMASTUS Albers, 1860.

*Thaumastus* ALB., as restricted by Pilsbry, Man. Conch. x, p. 43, type *T. hartwegi* Pfr.—*Orphnus* ALB., preoc, type *B. taunaisii*.—*Orphaicus* Schaufuss, in Paetel's Catal. 1864, p. 14, proposed as a substitute for *Orphnus*.—*Tatutor* JOUSS., 1887, type *T. tatutor*.

Shell rather large, narrowly umbilicate or imperforate, *long-ovate* with *lengthened spire* and blunt apex; moderately solid, *opaque*, usually dark, streaked, and generally having a light peripheral band. *Nepionic whorls*  $2\frac{1}{2}$  to 3, *sculptured with fine vertical waved or inter-*

rupted wrinkles, or thimble-pitted by regularly anastomosing wrinkles. Aperture less than half the shell's length, ovate, the *outer lip obtuse, not expanded or but slightly so*. Columellar lip reflexed, usually adnate, the short columella with a weak fold or none.

Anatomy known from a specimen of *T. magnificus* from Piquete, Sao Paulo, Brazil, sent by Dr. H. von Ihering. The long lung is densely veined anteriorly, and posteriorly between the kidney and intestine (pl. 49, fig. 9, nat. size. The preparation figured has been extensively torn, as indicated). The kidney is triangular and as long as the pericardium. The secondary ureter is a closed tube throughout.

The genital system (pl. 51, fig. 19, nat size), is Bulimuline. The penis is enlarged in the middle (fig. 17), having very thick, muscular walls and a small lumen (*c*). It is contracted above, plicate within, and receives the vas deferens some distance below the apex (see fig. 17). The retractor muscle is terminal. The base is encircled by a sheath, within which a loop of the vas deferens descends (fig. 18). The vagina is short, plicate within. The duct of the spermatheca is very long, and becomes abruptly narrower in the middle (pl. 51, fig. 21); its lumen has finely plicate walls.

The jaw (pl. 57, fig. 60) is composed of about a dozen broad flat plaits, well consolidated.

The radula has 44, 1, 44 teeth (pl. 57, fig. 61). The centrals are tricuspid, laterals and marginal teeth bicuspid, of the ordinary Helicid type commonly occurring in *Bulimulus*. The splitting of the ectocone of tooth 18, figured, is somewhat abnormal.

In *T. foreolatus* Binney found the jaw with over 50 delicate ribs, teeth 34, 1, 34, without side cusps on centrals and laterals.

Distribution, southern Brazil and Bolivia to the head waters of the Amazon in Peru and Ecuador.

I formerly considered this group a subgenus of *Strophocheilus*, on account of its comparatively large nepionic shell; but the anatomy of *T. taumaisii* var. *magnificus* shows *Thaumastus* to belong near *Bulimulus*, *Auris* and *Plekocheilus*. It has nothing to do with *Strophocheilus*. The sculpture of the apex repeats patterns occurring in *Bulimulus*. The teeth, jaw and genitalia are Bulimuline in their main features. The reticulation of the lung is like that of *Auris egregia*.

The species fall into four groups, as follows :

a. Shell distinctly perforate or umbilicate.

b. Large, solid species, with spiral series of granules; three earlier whorls densely wave-striate; peristome expanded, subreflexed. *Group of T. melanocheilus.*

b<sup>1</sup>. Smaller, more slender forms, with coarser, very irregular or dislocated wrinkles on the early whorls; peristome but slightly or not expanded. *Group of T. bitæniatus.*

a<sup>1</sup>. Shell imperforate.

b. Early whorls finely and densely wave-striate longitudinally. *Group of T. taunaisii.*

b<sup>1</sup>. Early whorls thimble-pitted. *Group of T. thompsoni.*

*Group of T. melanocheilus.*

- |                                  |                                  |
|----------------------------------|----------------------------------|
| T. melanocheilus Nyst, x, 44.    | T. granocinctus Pils., xiv, 126. |
| T. sangoæ Tschudi, x, 45.        | B. <i>flocinctus</i> Rolle.      |
| B. <i>pangoæ</i> Morel., x, 198. | T. foveolatus Rve., x, 46.       |
|                                  | B. <i>impressus</i> Tschudi.     |

*Group of T. taunaisii.*

- |                              |                                   |
|------------------------------|-----------------------------------|
| T. magnificus Grat., x, 46.  | T. achilles Pfr., x, 51.          |
| v. monozonalis Dh., x, 47.   | v. nehringi Mart., x, 51.         |
| T. tatutor Jouss., x, 47.    | T. hartwegi Pfr., x, 52, 198.     |
| T. taunaisii Fér., x, 48.    | <i>Zebra loxensis</i> Miller.     |
| ? <i>Helix pullata</i> Fér.  | T. loxostomus Pfr., x, 52.        |
| T. ascendens Pfr., x, 49.    | T. salteri Sowb., x, 52.          |
| T. plumbeus Pfr., x, 49.     | T. thompsoni Pfr., x, 53, 198.    |
| T. hector Pfr., x, 50.       | T. yanamensis Morel., x, 54, 198. |
| T. largillierti Pfr., x, 50. | T. viriatus Morel., x, 54.        |
| B. <i>consimilis</i> Rve.    | T. requieni Pfr., x, 55.          |

*Group of T. bitæniatus.*

- |                                 |                                    |
|---------------------------------|------------------------------------|
| T. spixii Wagn., x, 55.         | B. <i>bivittatus</i> Phil.         |
| ? B. <i>hyalinus</i> Spix.      | B. <i>bifasciatus</i> Phil.        |
| ? <i>Bulinus sordidus</i> King. | B. <i>fusiformis</i> Tschudi.      |
| T. inca Orb., x, 56.            | form <i>unicolor</i> Phil., x, 59. |
| T. tæniolus Nyst., x, 57.       | v. alutaceus Rve., x, 59, 198.     |
| T. brephoides Orb., x, 57, 198. | v. jelskii Lub., x, 58.            |
| T. iserni Phil., x, 57, 198.    | T. porphyreus Pfr., x, 60, 198.    |
| T. tarmensis Phil., x, 60.      | T. jaspideus Morel., x, 61.        |
| T. bitæniatus Nyst, x, 58; xiv, |                                    |

## Genus XENOTHAUMA Fulton, 1896.

This vol., p. 134. Type and sole species, *X. baroni*.

This is probably, as I have elsewhere noted, a *Scutalus* specialized in the whole structure of the post-nepionic shell; but so divergent that it deserves generic rank.

*X. baroni* Fult., xiv, 134. Peru.

## Genus BULIMULUS Leach, 1815.

Man. Conch., x, p. 125. Type *B. guadalupensis* Brug.

Shell varying from ovate-conic to oblong, column-shaped, or rarely depressed and Helicoid; umbilicate or imperforate. Aperture with the outer lip usually thin, sometimes expanded. Columella straight or concave below, weakly folded above, the margin reflexed. Apical whorls variously sculptured (but never with an even, minute sculpture of pits in spiral and vertical series).

The mantle generally bears two widely separated lobes. The kidney is the length of the pericardium and triangular. The reticulation of the lung is chiefly along the intestinal side, spreading to the other side near the pneumostome. The pulmonary vein dominates, though sometimes the first branch of the vena cava is well developed (pl. 53, figs. 30 to 33).

The free retractors are typical of the family, the left tentacular and pharyngeal bands being more or less united proximally, and the right tentacular band arises from the face of the columellar muscle (pl. 54, fig. 39, *B. dealbatus*). As in other genera of the family, the columellar muscle is adnate throughout to the adjacent face of the mantle.

The genital system is simple. The penis is long and generally twisted, the vas deferens and retractor muscle arising from its apex; it is generally encircled around the base by a muscular sheath. The duct of the spermatheca is generally about as long as the oviduct. Some branches of the right tentacular muscle band are attached to the vagina and to the body-wall near the external opening.

The jaw is arcuate and plaited, the plaits vertical in the middle, not converging to form a triangular area (pl. 57, fig. 62, *B. dealbatus mooreanus*).

The radula has but slightly curved transverse rows of teeth, which are of the normal Helicoid form. In the rhachidian teeth, the large mesocone usually is flanked by small ectocones. The laterals have

the mesocone large, ectocone well developed. This type is continued in the marginal teeth (pl. 57, fig. 63, *B. limnoides*, after Binney; fig. 64, *B. dealbatus mooreanus*). Distribution, from the southern United States to northern Patagonia.

The genus *Bulimulus* is more widely distributed than any other group of the family. It is also the least specialized; the genera preceding being variously specialized in shell characters, those following chiefly in characters of the teeth and jaws. It is likely that the common ancestors of all *Bulimulidæ* were similar to *Bulimulus* both in internal structure and shells.

The multitude of subgeneric and sectional names which have been proposed for minor groups of Bulimuli fall into three main divisions.

- I. Apical whorls smooth (p. xxiii.).
- II. Apical whorls irregularly wrinkled subvertically, or with the wrinkles waved, dislocated, or broken into a thimble-pitted reticulation (p. xxvi.).
- III. Apical whorls with regular, straight, vertical riblets (p. xxxii.).

#### DIVISION I. *Bulimuli with smooth apical whorls.*

The shell varies from obesely ovate to slender and column-shaped, or rarely Heliciform, and from umbilicate to imperforate. It is usually *calcareous and opaque*. The *apical whorls are smooth* and glossy, without sculpture of any kind. Aperture ovate or angular, the outer lip usually thin and simple, rarely expanded. Columella foldless, dilated above.

A group of plain-colored or whitish species characteristic of the Pacific slope and Andean highland, from Ecuador to Chili; with a few thinner, corneous or brownish forms, referred here with some doubt, in Bolivia and Argentina.

The species have in common a small, *smooth*, often teat-like nepionic shell. The subsequent growth is widely divergent in various forms, and hence a large number of "sections" have been established, based upon the contour assumed by the adult shell—natural groups, but of only minor systematic value.

#### Section *Platybostryx* Pilsbry, 1896.

Depressed, wider than high, acutely keeled at the periphery and around the broad, crater-shaped umbilicus.

B. *eremothauma* Pils., x, 129. Chili.

*Helix reentsii* Phil., preoc.

Section *Ataxas* Albers, 1850.

Long-conic, with 7-11 whorls coiled around a large, deep umbilicus. Type *B. umbilicaris*. Peru.

- |   |  |
|---|--|
| <i>B. umbilicaris</i> Soul., x, 130.    | <i>B. huayaboensis</i> Dautz., J. de C., 1902. |
| <i>B. infundibuliformis</i> Jay.        |  |
| <i>B. infundibulum</i> Pfr., x, 131.    | v. <i>attenuata</i> and <i>rudis</i> .         |
| v. <i>umbilicatellus</i> Pils., x, 131. | <i>B. moniezi</i> Dautz, xiv, 136.             |
| <i>B. tubulatus</i> Morel., x, 132.     | f. <i>albescens</i> Dautz.                     |
|   | <i>B. scalaricosta</i> Morel., x, 132.         |

Section *Bostryx* Troschel, 1847.

Turreted, wrinkled, the last whorl or two free or separated by deep sutures; umbilicus inconspicuous. Type *B. solutus*. Peru, Chili.

- |                                    |                                   |
|------------------------------------|-----------------------------------|
| <i>B. solutus</i> Trosch., x, 133. | <i>B. holostoma</i> Pfr., x, 134. |
|------------------------------------|-----------------------------------|

Section *Geopyrgus* Pils., 1896.

Turreted, *tapering*, rimate, composed of 9-10 whorls. Peru.  
*B. turritus* Brod., x, 135, 200.

Section *Geoceras* Pilsbry, 1896.

Column-shaped, composed of 16-19 narrow whorls. Type *B. columellaris*. Andes of Peru.

- |                                      |                                     |
|--------------------------------------|-------------------------------------|
| <i>B. columellaris</i> Rve., x, 136. | <i>B. veruculum</i> Morel., x, 137. |
| <i>B. cuspidatus</i> Morel., x, 137. |                                     |

Section *Peronæus* Alb., 1850.

Rimate or perforate, long-fusiform, slender, with 7-11 whorls. Type *B. pupiformis*.

(Group of *B. pupiformis*. Chili, Peru.)

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|---------------------------------------|--|
| <i>B. pupiformis</i> Brod., x, 138.   | <i>B. baeri</i> Dautz., xiv, 135.      |
| <i>B. anachoreta</i> Pfr., x, 139.    | <i>B. iocosensis</i> Dautz., xiv, 135. |
| <i>B. lactifluus</i> Pfr., x, 140.    | <i>B. emaciatius</i> Morel., x, 143.   |
| <i>B. atacemensis</i> Pfr., x, 140.   | <i>B. spiculatus</i> Morel., x, 144.   |
| <i>B. longurio</i> Crosse.            | <i>B. acromelas</i> Morel., x, 144.    |
| <i>B. nanus</i> Rve., x, 141.         | <i>B. lichenorum</i> Orb., x, 145.     |
| <i>B. leucostictus</i> Phil., x, 141. | <i>lichenorum</i> Orb.                 |
| <i>B. scabiosus</i> Sowb., x, 142.    | <i>lichenum</i> Beck.                  |
| <i>B. terebralis</i> Pfr., x, 142.    | <i>B. subcactorum</i> Pils., x, 145.   |
| <i>B. bisculptus</i> Pfr., x, 142.    | <i>B. tschudii</i> Trosch., x, 146.    |



*(Group of B. williamsi. Peru, Argentina.)*

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|---|---------------------------------|
| B. williamsi Pfr., x, 146.              | B. hamiltoni Rve., x, 149.      |
| B. peliostomus "Phil." Pfr., x,<br>147. | B. elatus Phil., x, 150.        |
| B. andiocus Morel., x, 147.             | B. cerataeme Pfr., x, 150.      |
| B. productus Phil., x, 148.             | B. biformis Pfr., x, 151.       |
| B. albicolor Morel., x, 148.            | B. woodwardi Pfr., x, 151.      |
| B. lesueureanus Mor., x, 149.           | B. calebaquinnus Doer., x, 151. |
|   | B. famatimus Doer., x, 152.     |

*(Group of B. rhodacme. Chili, Peru.)*

- |                              |                              |
|------------------------------|------------------------------|
| B. rhodacme Pfr., x, 152.    | B. voithianus Pfr., xi, 322. |
| B. pustulosus Brod., x, 153. | <i>hoithyanus</i> Ads.       |
| B. scalarioides Pl., x, 154. | <i>meridionalis</i> Rve.     |
|                              | <i>feisthameli</i> Hupé.     |

Section *Lissoacme* Pils., 1896.

Obese or ovate, umbilicate or perforate. Type *B. erythrostromus*.

*(Group of B. reentsi. Chala, Peru.)*

- |                           |                                 |
|---------------------------|---------------------------------|
| B. reentsi Phil., x, 155. | <i>B. denickei</i> Gray.        |
| <i>B. reentzi</i> Schauf. | <i>B. deneckeii</i> H. & A. Ad. |

*(Group of B. hennahi. Chili to Ecuador.)*

- |                               |                                    |
|-------------------------------|------------------------------------|
| B. styliger Beck., x, 156.    | B. sordidus Less., x, 163.         |
| <i>B. vittatus</i> Brod.      | B. guttatus Brod., x, 163.         |
| <i>B. lemniscatus</i> Dh.     | B. juana Cousin, x, 164.           |
| B. hennahi Gray, x, 156.      | B. laurentii Sowb., x, 164.        |
| <i>rubescens</i> Rve.         | <i>lorenzii</i> Orb.               |
| <i>lychnorum</i> Sowb.        | B. scutulatus Brod., x, 165.       |
| <i>cactorum</i> Orb.          | B. limonoicus Orb., x, 165.        |
| <i>virginalis</i> Morel.      | <i>cinereus</i> Rve.               |
| B. metamorphus Pils., x, 157. | B. depstus Rve., x, 181; xiv, 136. |
| B. limensis Rve., x, 158.     | <i>flagellatus</i> Pils., x, 166.  |
| B. ceroplasta Pils., x, 159.  | B. audicola Pfr., x, 166.          |
| B. acalles Pfr., x, 160.      | B. ulloae Phil., x, 167.           |
| B. erosus Brod., x, 160.      | B. apertus Pfr., x, 168.           |
| B. conspersus Brod., x, 160.  | B. (?) tumidulus Pfr., x, 168.     |
| B. coagulatus Rve., x, 161.   | <i>Bulinus inflatus</i> Brod.      |
| B. modestus Brod., x, 161.    | B. scalariformis Brod., x, 169.    |
| <i>striatulus</i> Sowb.       | B. rusticellus Mor., x, 170.       |
| <i>orbigny</i> Pfr.           | B. devians Dohrn, x, 170.          |
| B. delicatulus Phil., x, 162. | B. compactus Fult., xiv, 282.      |

(Group of *B. derelictus*. Chili, Ecuador.)

- B. derelictus* Brod., x, 172.      *B. umbilicatus* Mill., x, 172.  
*B. curtus* Koch.      Prov. Loja, Ecuador.

(Group of *B. erythrostomus*. Chili.)

- B. erythrostomus* Sowb., x, 173.      *B. mejillonensis* Pfr., x, 177.  
     *v. albus* Sowb., x, 174.      *callosus* Phil.  
     *olorinus* Ducl.      *mexilloensis* Schauf.  
*B. huascensis* Rve., x, 174.      *B. affinis* Brod., x, 177.  
*B. albicans* Brod., x, 175.      *v. paposensis* Pfr., x, 178.  
     *spixii* Pot. & Mich.      *B. callosus* Pfr., x, 178.  
*B. pruinosis* Sowb., x, 175.      *B. pervius* Pfr., xiv, 139.  
*B. rouaulti* Hupé, x, 176.  
*B. simpliculus* Pfr., x, 176; xiv,  
     137.

(Group of *B. striatus*. Peru, Ecuador.)

- B. striatus* King, x, 179.      *radiatus* Morel., x, 182.  
     *Buliminus striatellus* Bk.      *v. orophilus* Morel., x, 183.  
*B. piurapus* Alb., x, 180.      *v. balsanus* Morel., x, 184.  
*B. alausiensis* Cousin, x, 180.      *v. reconditus* Rve., x, 181.  
*B. delumbis* Rve., xiv, 138.      *B. cereicola* Morel., x, 184.  
*B. nigropileatus* Rve., x, 182;      *cercicola* Morel.  
     xiv, 137.      *B. munsteri* Orb., x, 185.  
     *v. stenacme* Pfr., x, 182.      *B. cambus* Gray.  
     *v. angrandianus*, Pils., xiv,      *B. bilineatus* Sowb., x, 187.  
     137.

(Group of *B. apodemetes*. Argentina, Bolivia.)

- B. apodemetes* Orb., x, 187.      *B. fayssianus* Pet., x, 192.  
     *pessulatus* Rve.      *B. turritellatus* Bk., x, 193.  
*B. centralis* Doer., x, 188.      *Helix turritella* Orb.  
*B. ventanensis* Pils., x, 189.      *v. pliculosa* Anc., xiv, 139.  
*B. conospirus* Doer., x, 189.      ? *B. luridus* Pfr., x, 194.  
*B. oxylabris* Doer., x, 190.      Habitat unknown.  
*B. stelzneri* Dohrn, x, 190.

DIVISION II. *Bulimuli with the nepionic whorls sculptured with waved, zigzag or irregular subvertical wrinkles, or with the wrinkles dislocated and broken more or less into granules, or anastomosing to form a netted or thimble-like pattern.*

This group of forms inhabits temperate and tropical South America, the Antilles and southern Mexico. The shell is ovate, less varied in form than in the preceding and following divisions.

Subgenus PLECTOSTYLUS Beck, 1837.

Manual xi, p. 2. In *B. chilensis* Semper found two small, widely separated body-lobes on the left margin of the mantle. The kidney is of the usual short, triangular form; genitalia simple, the penis with terminal retractor, spermatheca lying near the heart, on a long duct. The jaw is broad, strongly but irregularly ribbed. Radula with at least 101 teeth in a transverse row, the central tooth with short middle and obsolete side cusps, inner 14 laterals bicuspid, the inner cusp then appearing. Binney, who examined the same species, agrees as to the teeth. The rather strong development of the inner cusp gives the marginal teeth a strong resemblance to those of *Drymæus*. Type *B. peruvianus*. Almost wholly a group of the Chilean coastal region.

- |                                       |                                       |
|---------------------------------------|---------------------------------------|
| <i>B. coturnix</i> Sowb., xi, 3.      | <i>B. chilensis</i> Less., xi, 8.     |
| <i>B. broderipii</i> Sowb., xi, 4.    | <i>Achatina chiliensis</i> Less.      |
| v. <i>elongatus</i> Orb., xiv, 140.   | <i>B. granulatus</i> Pot. & Mich.     |
| <i>B. buschii</i> Pfr., xi, 5.        | <i>B. graniger</i> Beck.              |
| <i>B. variegatus</i> Pfr., xi, 5.     | <i>B. aldimata</i> Hupé.              |
| <i>rupicolus</i> Rve.                 | <i>Partula flavescens</i> King.       |
| <i>B. moestai</i> Dkr., xi, 6.        | <i>B. reflexus</i> Pfr., xi, 9.       |
| <i>B. peruvianus</i> Brug., xi, 7.    | <i>B. ochsenii</i> Dkr., xi, 10.      |
| <i>corrugatus</i> King.               | <i>arbutorum</i> Phil.                |
| <i>gravesi</i> King.                  | <i>B. coquimbensis</i> Brod., xi, 10. |
| <i>B. punctulifer</i> Sowb., xi, 317. | v. <i>perelegans</i> Pils., xi, 11.   |
| <i>B. prolatus</i> Gld., xi, 318.     | <i>elegans</i> Pfr.                   |
|                                       | <i>B. filaris</i> Pfr., xi, 316.      |
|                                       | <i>hilarus</i> H. & A. Ad.            |

Subgenus SCUTALUS Alb.

Man. Conch. xi, p. 12.

The genital system in *B. proteiformis*, *proteus* and *versicolor* is simple, the penis and spermatheca duct long (pl. 52, fig. 29, *B. versicolor*, after Strebel). The jaw is strong, arcuate, with rather wide plaits, not imbricating (pl. 59, fig. 5, *B. proteus*, after Strebel). Radula with 90 to 96 teeth in a transverse row in *B. proteiformis*,

103 to 107 in *B. proteus*. The rhachidian and inner lateral teeth have no ectocones, an ectocone appearing on the 17th or 18th lateral. The marginal teeth are bicuspid (pl. 59, fig. 2, *B. proteiformis*, after Semper).

(*Group of B. proteus.* Peru.)

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|---|--|
| <i>B. proteus</i> Brod., xi, 13; xiv, 140.    | <i>B. baroni</i> Fult., xi, 172; xiv, 142. |
| <i>sordidus</i> Dh.                           | <i>B. steerei</i> Pils., xiv, 140.         |
| <i>B. mutabilis</i> Brod., xi, 14.            | <i>B. versicolor</i> Brod., xi, 16.        |
| <i>sordidus</i> Rve.                          | <i>varians</i> Küster.                     |
| <i>B. proteiformis</i> Dohrn, xi, 14.         | <i>v. callaoensis</i> Pils., xi, 16.       |
| <i>B. coræformis</i> Pils., xi, 15; xiv, 142. | <i>B. aquilus</i> Rve., xi, 17.            |
|   | ? <i>B. mercurius</i> Pfr., xiv, 140.      |
| <i>B. cretaceus</i> Pfr., xiv, 141.           |  |

(*Group of B. tupacii.* Andes of Peru and Bolivia.)

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|--|--|
| <i>B. revinctus</i> Hupé, xi, 17.            | <i>B. purpuratus</i> Rve., xi, 21.       |
| <i>B. gayi</i> Pfr., xi, 18.                 | <i>B. weddelli</i> Hupé, xi, 21.         |
| <i>B. tupacii</i> Orb., xi, 19; xiv, 142.    | <i>B. nemorensis</i> 'Ph.' Pfr., xi, 22. |
| <i>B. thamnoides</i> Orb., xi, 19; xiv, 142. | <i>B. angrandi</i> Mor., xi, 23.         |
|  | <i>B. alauda</i> Hupé, xi, 23.           |
| <i>B. pluto</i> Crosse, xi, 20.              | <i>B. nuncius</i> Rve., xi, 24.          |
| <i>B. petiti</i> Pfr., xi, 21.               |  |

(*Group of B. culmineus.* Andes of Peru and Bolivia.)

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|--------------------------------------|--|
| <i>B. culmineus</i> Orb., xi, 25.    | <i>B. edwardsi</i> Mor., xi, 27.         |
| <i>jussieui</i> 'Val.' Pfr.          | <i>B. badius</i> Sowb., xi, 28.          |
| <i>B. subjussieui</i> Pils., xi, 26. | <i>B. polymorphus</i> Orb., xi, 28, 320. |
| <i>jussieui</i> Hupé.                | <i>B. promethus</i> Cr., xi, 28.         |
| <i>B. lithoicus</i> Orb., x, 179.    | <i>B. ferrugineus</i> Rve., xi, 29.      |
| <i>culminans</i> Rve.                | <i>B. peristomatus</i> Doer., xi, 29.    |
| <i>B. pentlandi</i> Rve., xii, 27.   |  |

(*Group of B. æquatorius.* Andes of Ecuador.)

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|---------------------------------------|-------------------------------------|
| <i>B. æquatorius</i> Pfr., xi, 30.    | <i>B. caliginosus</i> Rve., xi, 33. |
| <i>B. ochraceus</i> Mor., xi, 31.     | <i>B. cousini</i> Jouss., xi, 33.   |
| <i>B. cotopaxiensis</i> Pfr., xi, 31. | <i>B. quitensis</i> Pfr., x, 158.   |
| <i>B. subfasciatus</i> Pfr., xi, 32.  | <i>v. irregularis</i> Pfr., xi, 34. |
| <i>B. anthisanensis</i> Pfr., xi, 32. | <i>v. catlowiae</i> Pfr., xi, 34.   |
| <i>antisananensis</i> Alb. Mart.      |                                     |

## Subgenus BULIMULUS (restricted).

Man. Conch. xi, p. 35. Type *B. guadalupensis* Brug. Includes *Leptomerus* Albers

The shell is rather small, brown or corneous-brown, rarely with a few wide bands; lip and columella simple.

The kidney is as long as the pericardium, and triangular. The venation of the lung is chiefly on the intestinal side, and is faint except for the pulmonary vein, which has no large branches (pl. 53, fig. 31, *B. guadalupensis*. The figure is diagrammatic and the veins on the cardiac side are represented too strong).

Genitalia (pl. 52, fig. 24, *B. guadalupensis*, form *acutus* Leach, from Guadalupe) characterized by the long and very much twisted penis, and the spermathecal duct, which is shorter than in other groups of *Bulimulinae*, and *inserted upon the atrium*, there being no vagina. Other organs as usual. In a Porto Rican form identified as *fraterculus*, Pfeffer found the penis only moderately contorted and the spermathecal duct very long (Beiträge, v, p. 56). This agrees with Fischer's dissection of a specimen of *guadalupensis* from Pointe-à-Pitre (pl. 59, fig. 3) in which the duct of the spermatheca is very long. The penis is apparently provided with a flagellum, figured but not mentioned by Fischer. No flagellum is mentioned by Semper, who dissected a specimen from Barbados, and I think it undoubtedly a mistake.

The jaw is of the vertically plaited type, with 15-18 plaits, not converging in the middle. Radula characterized by tricuspid central teeth, the middle cusp very long, reaching over the margin of the basal plate. Laterals bicuspid (pl. 57, fig. 63, *B. limnoides*, after Binney).

*Antillean Species.*

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|--|---------------------------------------|
| <i>B. guadalupensis</i> Brug., xiv, 143. | <i>B. nicholli</i> A. D. B., xi, 40.  |
| <i>H. exilis</i> Gmel., xi, 37.          | <i>B. riisei</i> Pfr., xi, 41.        |
| <i>B. acutus</i> Leach.                  | <i>B. lehmanni</i> Pfr., xi, 42.      |
| <i>B. trifasciatus</i> Leach.            | <i>B. limnoides</i> Fér., xi, 42.     |
| <i>B. rubrifasciatus</i> Rve.            | <i>lymnoides</i> Rve.                 |
| <i>B. simplex</i> Beck.                  | <i>limnoides</i> Alb.                 |
| (?) <i>B. antiguensis</i> Gldg., Swains. | <i>B. chrysalis</i> Pfr., xi, 43.     |
|  | <i>B. semicinctus</i> Pils., xi, 44.  |
| v. <i>eyriesii</i> Drou., xi, 39, 320.   | <i>B. lherminieri</i> Fisch., xi, 44. |
| <i>fraterculus</i> auct., xiv, 143.      | <i>B. houelmontensis</i> Cr., xi, 45. |

- B. fraterculus "Fer.," P. & M., xi, 46.  
 B. diaphanus Pfr., xi, 47.  
 B. martinicensis Pfr., xi, 47.  
 B. mazei Cr., xi, 48.  
 B. barbadensis Pfr., xi, 48.  
*fuscus* Gldg.  
 (?) B. stenogyroides Gupp., xi, 49.  
 B. sepulcralis Poey, xi, 49.  
*urinarius* Poey., *olim.*  
 (?) B. indistinctus Pfr., xi, 144.  
*monilifer* Rve.

*Central American Species.*

- B. inermis Morel., xi, 51.  
 B. coriaceus Pfr., xi, 51; xiv, 143.  
*behrendti*, Pfr., *berendti* Pfr.  
 (?) B. umbraticus Rve., xi, 52; xiv, 144.  
 B. unicolor Sowb., xi, 53.  
   v. istapensis C. & F., xi, 53.  
   v. petenensis Morel., xi, 54.  
 B. corneus Sowb., xi, 54.  
   v. nubeculatus Pfr., xi, 55.  
   v. minor Mart., xi, 56.  
 B. sarcodes Rve., xi, 56.  
 B. dysoni Pfr., xi, 56.  
   v. ignavus Rve., xi, 57.

*Species of Northwestern South America.*

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|-----------------------------------|----------------------------------|
| B. dysoni Pfr., xi, 57; xiv, 144. | B. hyaloideus Pfr., xi, 61.      |
| B. buenavistensis Pils., xi, 59.  | B. glandiniformis Sowb., xi, 61. |
| <i>corneus</i> Lea.               | B. krebsianus Pils., xi, 62.     |
| B. juvenilis Pfr., xi, 59.        | B. hachensis Rve., xiv, 144.     |
| B. cacticolus Rve., xi, 60.       | B. fontainii Orb., xi, 62.       |
| B. erectus Rve., xi, 60.          | B. ucayalensis Cr., xi, 63.      |
| B. marmatensis Pfr., xi, 61.      | B. molecillus Rve., xi, 63.      |

*Species of N. E. South America to Argentina.*

Argentine species described by Doering and Strobel are of uncertain position, and may belong here or to *Lissoacme* (page xxvi).

- B. orthodoxus Dr., xi, 64.  
 B. egannus Pfr., xi, 64.  
 B. tenuissimus Orb., xi, 64, 320.  
     *thoreyi* Beck.  
 B. puellaris Rve., xi, 66.  
 B. gorritiensis Pils., xi, 66.  
 B. sporadicus Orb., xi, 67.  
     *subtropicalis* Doer.  
     v. bonariensis Strobl., xi, 68.  
     v. montevidensis Pfr., xi, 68.  
     *gelidus* Rve.

- |                                |                                 |
|--------------------------------|---------------------------------|
| B. corumbaensis Pils., xi, 68. | B. fourmiersi Orb., xi, 71.     |
| <i>amœnus</i> Bonnet.          | B. simplex Hupé, xi, 72.        |
| B. vesicalis Pfr., xi, 69.     | B. heloicus Orb., xi, 72.       |
| v. uruguayanus Pils., xi, 69.  | B. nivalis Orb., xi, 72.        |
| B. rushii Pils., x, 70.        | B. plicatulus Pfr., xi, 72.     |
| B. mendozanus Strob., xi, 71.  | <i>pliculatus</i> Pfr.-Cless.   |
| v. bonaerensis Doer., xi, 319. | B. castelnaui Pfr., xi, 73.     |
| v. azulensis Doer., xi, 319.   | B. luteolus Anc., xiv, 145.     |
| B. tortoranus Doer., x, 192.   | B. stilbe Pils., xiv, 145.      |
| B. cordilleræ Strob., x, 191   | B. dukinfieldi Melv., xiv, 146. |
| B. monticola Doer., x, 191..   | B. marcidus Rve., xiv, 146.     |
| B. aguirrei Doer., xi, 320.    |                                 |

*Habitat unknown.*

- |                                 |                              |
|---------------------------------|------------------------------|
| B. indistinctus Pfr., xiv, 144. | B. inutilis Rve., xi, 73.    |
| <i>monilifer</i> Rve.           | B. haplochrous Pfr., xi, 74. |
| B. transparent Rve., xi, 73.    |                              |

Section *Dentaxis* Pilsbry, 1902.

Cylindric-tapering, the nepionic shell with slight waved wrinkles and stronger spiral striæ; columella bearing a tooth-like fold; outer lip thin and unexpanded.

- B. dentaxis Pils., xiv, 143. Peru.

Section *Rhinus* Albers, 1860.

Nepionic whorls finely and densely zigzag striate or with interrupted waved striæ, the cuticle elsewhere hairy or bristly in spiral lines. Type *B. heterotrichus*.

The jaw of *B. constrictus*, examined by Schako, is composed of 11 wide plaits. The radula has 27, 1, 27 teeth, in rows straight in the middle, a little arcuate at the ends; centrals tricuspid, laterals bicuspid; both radula and jaw agreeing with those of *Bulimulus s. str.*

All of the species are Brazilian except *B. constrictus*, from Venezuela, and *argentinus*, from Entre-rios.

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|-------------------------------------|------------------------------|
| B. heterotrichus Moric., xi, 75.    | B. longiseta Moric., xi, 77. |
| (?) <i>Helix tumida</i> Gmel.       | B. scobinatus Wood, xi, 77;  |
| v. subtenuis Pils., xi, 76.         | xiv, 147.                    |
| B. velutinohispidus Moric., xi, 76. | B. ciliatus Gld., xi, 78.    |
| <i>hirtus</i> Beck.                 | B. koseritzi Cless., xi, 79. |

- |                              |                                 |
|------------------------------|---------------------------------|
| B. sarcochilus Pfr., xi, 80. | B. pubescens Moric., xi, 81.    |
| B. constrictus Pfr., xi, 80. | B. argentinus Anc., xiv, 147.   |
| <i>tateanus</i> Guppy.       | B. heterogrammus Mor., xi, 321. |
| <i>angosturensis</i> Grun.   |                                 |

DIVISION III. *Bulinuli with the nepionic whorls sculptured with regular, straight vertical riblets.*

Discontinuously distributed from the south-central United States southward to the Galapagos and Peru in the west, and Argentina in the east. Sufficient magnification usually shows delicate spiral striæ between the riblets of the nepionic shell. In *Neopetræus* and *Drymæus* this sculpture becomes far more strongly developed. The shell is dull, brown or white, sometimes streaked but very rarely banded. The contour varies from ovate to pillar-shaped. The sections are separated chiefly by their geographic distribution, and merely stand for groups of species of common ancestry, none of which have diverged much structurally from the precursor of the entire series.

Section *Protoglyphus* Pils., 1897.

Man. Conch. xi, p. 84.

A group of northern and eastern South America, extending into some of the Caribbean islands. The Peruvian species are whitish and calcareous; the others are thin, brown or corneous, and frequently hairy. Binney found the jaw and teeth of *B. durus* similar to those of typical *Bulimulus*.

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|--------------------------------------|--------------------------------------|
| B. pilosus Guppy, xi, 85.            | B. crepundia Orb., xi, 90.           |
| B. sanctæluçiæ Sm., xi, 86.          | <i>constrictus</i> Rve.              |
| <i>v. lucia</i> Pils., xi, 86.       | <i>redditus</i> Rve.                 |
| B. chrysaloides Pils., xi, 87.       | B. rivasii Orb., xi, 91.             |
| B. durus Spix, xi, 87.               | B. trichodes Orb., xi, 92; xiv, 148. |
| B. ovulum Rve., xi, 88.              | B. exornatus Rve., x, 171; xiv,      |
| B. pachys Pils., xi, 88.             | 137, 282.                            |
| B. endioptus Pils., xi, 89.          | *    *    *    *    *                |
| B. montivagus Orb., xi, 90.          | B. pileiformis Moric., xiv, 149.     |
| <i>cutisculptus</i> Anc., xiv, 147.  | *    *    *    *    *                |
| <i>v. chacoensis</i> Anc., xiv, 147. | B. glyptocephalus Pils., xi, 93.     |
| B. polloneræ Anc., xiv, 148.         | B. sarcochrous Pils., xi, 93.        |
|                                      | B. hæmatospira Pils., xiv, 149.      |



Section *Næsiotus* Albers, 1850.

*Næsiotus* ALB., Die Heliceen, p. 162, + *Rhaphiellus* PFR. + *Pelecostomu* Reibisch (in part). Man. Conch., xi, p. 94.

A group of rather small species, including all *Bulimulidæ* of the Galapagos Islands. The surface is frequently wrinkled and generally striate spirally.

The genital system (pl. 59, fig. 6, *B. nux*, after Binney) is simple, penis long and slender, with terminal vas deferens. The duct of the ovate spermatheca is about as long as the penis, much shorter than the oviduct, and arises from the atrium. The jaw is composed of numerous flat plaits, 12 in *B. bauri* to 18 in *B. nux*, and is similar to that of typical *Bulimulus*. The radula has 15.9.1.9.15 teeth in *B. bauri*, 13.9.1.9.13 in *B. eschariferus* var. *ventrosus*, 31.9.1.9.31 in *B. nux*. The teeth (pl. 59, fig. 8, *B. bauri*, after Dall) are essentially alike in many species examined, the centrals being tricuspid, with the middle cusp large, as long as the basal plate; laterals bicuspid. The marginal teeth have a long, bifid inner cusp, and the *outer cusp is split into several denticles*. In this last character only does *Næsiotus* differ from typical *Bulimulus* in what is known of the soft anatomy, though the duct of the spermatheca is somewhat shorter than usual in *Bulimulus*. The splitting of the outer cusp indicates terrestrial rather than arboreal feeding.

- |                                      |                                     |
|--------------------------------------|-------------------------------------|
| B. achatellinus Fbs., xi, 99.        | B. calvus Sowb., xi, 105.           |
| <i>achatinellinus</i> Pfr.           | B. nucula Pfr., xi, 106.            |
| <i>achatinellus</i> Ads.             | B. galapaganus Pfr., xi, 107.       |
| B. nux Brod., xi, 100.               | B. eschariferus Sowb., xi, 108 ;    |
| <i>nuciformis</i> Petit.             | xiv, 152.                           |
| v. <i>incrassatus</i> Pfr., xi, 102. | <i>rugulosus</i> Rve.               |
| v. <i>verrucosus</i> Pfr., xi, 102.  | <i>bizonalis</i> Anc.               |
| v. <i>asperatus</i> Alb., xi, 102.   | <i>subconoidulis</i> Anc.           |
| <i>invalidus</i> Reib.               | v. <i>pileatus</i> Dall, xi, 109.   |
| B. approximatus Dall, xiv, 150.      | v. <i>ventrosus</i> Reib., xi, 109. |
| B. rugulosus Sowb., xi, 103.         | B. perspectivus Pfr., xi, 110.      |
| v. <i>infuscatus</i> Anc., xi, 103.  | <i>rugulosus</i> Reib.              |
| v. <i>nudus</i> Reib., xi, 103.      | B. snodgrassi Dall, xiv, 150.       |
| B. planospira Anc., xi, 104.         |                                     |
| B. ustulatus Sowb., xi, 104.         |                                     |
| <i>venustus</i> Reib.                |                                     |

- B. jacobi* Sowb., xi, 111; xiv, 151.  
 (?) *arellana* Beck.  
*v. pallidus* Reib., xi, 112.  
*v. cinereus* Reib., xi, 112.  
*vermiculatus* Dall.  
*B. olla* Dall, xi, 113.  
*jacobi* Rve.  
*B. tanneri* Dall, xi, 113; xiv, 152.  
*fanneri* Dall.  
*B. duncanus* Dall, xi, 114; xiv, 152.  
*B. darwini* Pfr., xi, 115.  
*manini* Cpr.  
*B. wolfi* Reib., xi, 115.  
*B. hoodensis* Dall, xiv, 151.  
*B. unifasciatus* Sowb., xi, 116.  
*B. simrothi* Reib., xi, 117.  
*tortuganus* Dall.  
*B. bauri* Dall, xi, 118.  
*B. amastroides* Anc., xi, 118.  
*B. curtus* Reib., xi, 119.  
*anceyi* Dall.  
*B. canaliferus* Reib., xi, 119.  
*B. sculpturatus* Pfr.; xi, 120.  
*B. rugiferus* Sowb., xi, 121.  
*B. nesioticus* Dall, xi, 122.  
*B. reibischi* Dall, xi, 122.  
*B. indefatigabilis* Dall, xiv, 152.  
*B. habeli* Stearns, xi, 123.  
*terebra* Reib.  
*B. chemnitzoides* Forbes, xi, 124.  
*lima* Reib.

#### Section *Orthotomium* Crosse and Fischer.

Manual xi, p. 125.

The mantle has two short, widely separated lobes, with another near the anal orifice (pl. 53, fig. 32, *B. montezuma*).

The kidney and lung are as usual in the subfamily; the venation of the latter being confined to the area between the last fold of the gut and the pulmonary vein, and anteriorly on the cardiac side as far as the first branch of the vena cava. Elsewhere the venation is very slightly developed (pl. 53, fig. 30, *B. dealbatus*; fig. 33, *B. montezuma*, both double natural size).

The muscles are as usual in the family (pl. 54, fig. 39, *B. dealbatus*).

Genitalia. The long penis is moderately twisted, bears the retractor muscle at the apex, the vas deferens at or near it, and is encircled by a muscular sheath at the base. The vagina is moderately long; the spermatheca oval or globose, on a duct fully as long as the oviduct (pl. 52, fig. 23, *B. dealbatus*; fig. 25, *B. montezuma*, double natural size; fig. 28, *B. pallidior*, three times natural size).

The jaw is arcuate, bearing flat plaits which do not imbricate, and

are parallel in the middle (pl. 57, fig. 62, *B. d. mooreanus*). The radula (pl. 57, fig. 64, *B. d. mooreanus*), as in typical *Bulimulus*, the lateral and marginal teeth being bicuspid, centrals with small or subobsolete ectocones.

Distribution, Central and Northern Mexico, Lower California, and the Southwestern United States.

*Group of B. alternatus.* N.-E. Mexico, Texas to Ky.

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|--|---|
| <i>B. durangoanus</i> Mart., xi, 127.  | <i>v. schiedeanus</i> Pfr., xi, 131.    |
| <i>B. dealbatus</i> Say, xi, 128; xiv. | <i>nireus</i> Hegewisch.                |
| 152.                                   | <i>candidissimus</i> Nyst.              |
| <i>liquabilis</i> Rve.                 | <i>xanthostomus</i> Wieg.               |
| <i>confinis</i> Rve.                   | <i>v. patriarcha</i> W. G. B. xi, 132.  |
| <i>v. nigromontanus</i> Dall, xi,      | <i>B. alternatus</i> Say, xi, 132; xiv, |
| 128.                                   | 152.                                    |
| <i>v. ragsdalei</i> Pils., xi, 129.    | <i>lactarius</i> Mke.                   |
| <i>v. pasonis</i> Pils., 1902.         | <i>v. mariæ</i> Alb., xi, 133.          |
| <i>v. mooreanus</i> 'WGB.' Pfr. xi,    | <i>binneyanus</i> Pfr.                  |
| 130.                                   | <i>galeottii</i> Nyst.                  |
| <i>schiedeanus</i> auct.               | <i>albidus</i> Taylor.                  |

*Group of B. sufflatus.* Lower California.

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|---------------------------------------|-------------------------------------|
| <i>B. sufflatus</i> Gld., xi, 136.    | <i>B. recognitus</i> Mab., xi, 137. |
| <i>vasicalis</i> Gld.                 | <i>B. pilula</i> W. G. B., xi, 138. |
| <i>juarezi</i> Pfr.                   | <i>B. cooperi</i> Dall, xi, 139.    |
| <i>v. insularis</i> Coop., xi, 137.   | <i>B. decipiens</i> Coop., xi, 139. |
| <i>v. chinchensis</i> Coop., xi, 137. | <i>B. levis</i> Dall, xi, 140.      |

*Group of B. montezuma.* Lower Cal.; Sinaloa.

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|-------------------------------------|------------------------------------|
| <i>B. excelsus</i> Gld., xi, 141.   | <i>B. acholus</i> Mab., xi, 143.   |
| <i>elatus</i> Gld.                  | <i>B. cosmicus</i> Mab., xi, 144.  |
| <i>v. sinaloæ</i> Pils., xi, 142.   | <i>B. montezuma</i> Dall, xi, 144. |
| <i>B. pallidior</i> Sowb., xi, 142. | <i>proteus</i> auct. Amer.         |
| <i>vegetus</i> Gld.                 | <i>B. baileyi</i> Dall, xi, 145.   |
| <i>v. striatulus</i> Dall, xi, 143. | <i>B. gabbi</i> C. & F., xi, 147.  |
| <i>vegexspiza</i> Coop.             |                                    |

*Group of B. inscendens.* Lower California.

- B. xantusi* W. G. B., xi, 148.      *B. cacotyceus* Mab., xi, 150.  
*B. digueti* Mab., xi, 148.      *B. inscendens* W. G. B., xi, 150.  
*B. beldingi* Coop., xi, 149.  
    *v. alta* Dall, xi, 149.  
    *v. monticola* Dall, xi, 150.

Section *Plicolumna* Cooper, 1895.

Vol. xi, p. 151. Slender and column-shaped. Distribution, Lower California.

- B. artemisia* W. G. B., xi, 152.      *B. abbreviatus* Coop., xi, 153.  
    *artemesia* auct.      *B. ramentosus* Coop., xi, 153.

Section *Sonorina* Pilsbry, 1896.

*Leptobyrsus* C. & F. not *Leptobyrsa* Stal. Columella bearing a strong, callous lamella within the last whorl. Distribution, Lower California.

- B. rimatus* Pfr., xi, 157.      *B. vesityianus* Dall, xi, 160.  
    *bryanti* Coop.      *B. lepidovagus* Mab., xi, 161.  
*B. spirifer* Gabb, xi, 158.      *B. dentifer* Mab., xi, 161.  
    *v. orthelasmus* Pils., xi, 159.      *B. dismenicus* Mab., xi, 162.  
*B. lamellifer* Pils., xi, 160.      *B. subspirifer* Mab., xi, 162.

## Genus NEOPETRÆUS Martens, 1885.

Manual, xi, p. 163; xiv, p. 152. Type *N. millegranus* Mart.

This group is closely related to *Drymæus*, from which the shell differs in having the vertical riblets of the nepionic shell wider spaced and stronger than the spirals; though both are sometimes obsolete, leaving the apex smooth.

The jaw is like that of *Drymæus*, composed of 21 (*lobbi*, pl. 59, fig. 1, after Binney) to 31 (*altoperuvianus*) delicate imbricating ribs, which converge in the middle. The radula is broad, with numerous teeth in each row (90.1.90 in *N. lobbi*, pl. 59, fig. 9, after Binney). The centrals have a single long cusp; the laterals bear a very long, oblique, broad cusp, notched near the apex, the central and inner cusps being conerescent. The marginal teeth in *N. lobbi* have a large ectocone, and the united middle and inner cusps are shorter thus resembling the laterals of *Drymæus*, but in *N. altoperuvianus* (pl. 59, fig. 4, after Binney) the marginal teeth are of the same type as the laterals. The anatomy is otherwise unknown.

Distribution, Andes of Peru.

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|------------------------------------|-------------------------------------|
| N. binneyanus Pfr., xi, 164.       | (?) N. heterogyrus Phil., xi, 174.  |
| N. vadium Pils., xi, 165.          | N. sowerbyi Rve., xi, 174.          |
| N. filiola Pils., xi, 165.         | N. arboriferus Pils., xi, 175; xiv, |
| N. cora Orb., xi, 166.             | 153.                                |
| v. unicolor Pfr., xi, 167.         | f. rectistrigatus Pils., xi, 176.   |
| N. tessellatus Shutt., xi, 167.    | f. latistrigatus Pils., xi, 176.    |
| v. atahualpa Dohrn, xi, 168.       | N. patasensis Pfr., xi, 176; xiv,   |
| v. perincrassatus Pils., xi, 169.  | 153.                                |
| N. papillatus Morel., xi, 169.     | N. lobbi Rve., xi, 177; xiv, 153.   |
| N. catamarcanus Pfr., xi, 170.     | v. ptychostylus Pfr., xi, 178.      |
| N. millegranus Mart., xi, 170.     | N. decussatus Rve., xi, 178; xiv,   |
| N. rhodolarynx Rve., xi, 171.      | 154.                                |
| devillei Hupé.                     | v. myristicus Rve., xi, 178.        |
| N. platystomus Pfr., xi, 172; xiv, | v. brownii Pils., xi, 179.          |
| 153.                               | N. cœrulescens Pfr., xi, 180.       |
| N. altoperuvianus Rve., xi, 173.   | v. columna Pils., xi, 180.          |
| v. gracilior Pils., xi, 173.       |                                     |

Genus OXYCHONA Mörch, 1852.

Man. Conch. xi, p. 181. Type *O. bifasciata* Burrow.

Shell trochiform, with conspicuous peripheral keel, the nepionic whorls evenly latticed, as in *Drymaeus*. Jaw composed of many vertical plaits, not converging in the middle. Radula with V-shaped rows of nearly similar teeth throughout, the middle cusps very large, spatulate; ectocones wanting on the central, present on the lateral teeth. Basal plates rather large and squarish (see vol. ix, p. 189, pl. 51, figs. 9, 10, 11, teeth and jaw of *O. bifasciata*). Genitalia unknown.

In the peculiar teeth of the radula, arranged in strongly V-shaped rows, *Orychona* resembles *Zaplagius*. But in the latter group entocones are distinctly developed on all but the three inner lateral teeth, and the basal-plates are narrow. *Liostracus* has a somewhat similar dentition, owing to the wide mesocones; but the rows of teeth are nearly straight, and the structure of both basal-plate and cusps is more like normal *Drymaeus*. In *Zaplagius* the outer marginal teeth are distinctly less modified than the rest of the radula, but in *Orychona* the whole series is modified.

Species all of eastern Brazil, and evidently arboreal. The pertinence of *O. gyrina* Val. to *Orychona* is doubtful, as neither the

apical sculpture or the dentition is known. It probably groups with *B. pileiformis* Moric.

*O. bifasciata* Burr., v, 129; xi, *O. longhostoma* Mke., v, 130.

181.

?*O. gyrina* Val., v, 131.

v. *mimarum* Anc., xiv, 154.

#### Genus ZAPLAGIUS Pilsbry, 1896.

*Nautilus* ix, p. 115, Feb., 1896; *Man. Conch.* xi, 185. Type *Helix navicula* Wagn.—*Navicula* Spix, 1827, not of Blainville, 1825.—*Otostomus* of some authors.

Shell conic or obliquely conic, with the apical sculpture of typical *Drymæus*, and a keel around the truncate or flattened base; the last whorl ascending, lip expanded or reflexed, thin.

Jaw deeply arched, with narrow plaits (43 in *aurisleporis*) converging mesially as in *Drymæus*.

Two widely separated lobes are on the left edge of the mantle. The kidney is the length of the pericardium (*Semper*).

The genital system (pl. 50, fig. 8, *Z. aurisleporis*, after *Semper*) is simple, the long slender penis having a terminal retractor, and the ovate spermatheca a long duct, as in *Bulinulus*, *Drymæus*, etc.

The radula (of *Z. aurisleporis*, pl. 58, figs. 70–74, from a specimen supplied by Dr. H. v. Ihering) has 37.1.37 teeth in V-shaped rows (pl. 58, fig. 74). The median tooth of each row has an exceedingly large, rounded cusp, the basal-plate being narrow except under the cusp. The lateral teeth have similar but subangular cusps, more or less emarginate near the inner side, indicating the concrescence of an entocone with the mesocone; and far back there is a minute, vestigial outer cusp, remote from the main cusp, as in some *Urocoptidæ*. The fourth to sixth laterals show the entocone as a short prong, becoming stronger as we pass outward on the radula (fig. 70, 11th and 12th, and fig. 71, 21st and 22d teeth). The marginal teeth (pl. 58, fig. 73, 33d to 37th teeth) have a large mesocone, a retreating and distinct entocone, and the ectocone has traveled forward, become larger and usually bifid. They thus approximate to the marginals of typical *Drymæus*.

With the apical sculpture, jaw, and general anatomy of *Drymæus*, this group seems sufficiently specialized in dentition and shell to stand as a distinct genus. Its close relationship to *Orychona* can hardly be doubted. The eastern Brazilian *Otostomus signatus* may also be related, but its soft anatomy is unknown.

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|--------------------------------------|--|
| <i>Z. navicula</i> Wagn., xi, 186.   | <i>Z. aurisleporis</i> Brug., xi, 189. |
| <i>N. fasciata</i> Spix.             | <i>B. lagotis</i> Mke.                 |
| v. <i>lateritius</i> Pils., xi, 320. | <i>Auricula leporis</i> Lam.           |
| <i>Z. involutus</i> Mart., xi, 187.  | <i>Stenostoma auritum</i> Spix.        |
| <i>Z. uranops</i> Pils., xi, 188.    | f. <i>intensior</i> Pils., xi, 190.    |
| <i>Z. lateralis</i> Mke., xi, 188.   | <i>Z. aurismuris</i> Moric., xi, 191.  |
|                                      | <i>Helix uniaugulata</i> Fér.          |

Genus DRYMÆUS Albers, 1850.

*Drymæus* ALB., Die Hel., p. 155, types *B. xanthostoma* and *B. hygrohylæus*.—PILSBRY, Manual, xi, p. 191.

In this group the shell is generally of lighter structure and brighter color than in *Bulimulus*. With the exception of the aberrant sub-genus *Leiostracus*, all of the species have a characteristic pattern of apical sculpture, consisting of minute pits arranged with great regularity in spiral and vertical lines.

The external anatomy, free muscles, and pallial organs are practically identical with those of *Bulimulus* (pl. 54, fig. 40, *D. acervatus* Pfr., x 2). The secondary ureter is closed nearly to the end. The genital system is similar to that of *Bulimulus*.

The jaw is strongly arched, thin and flexible, composed of many narrow plaits, narrowly imbricating, and obliquely converging toward the median line, usually leaving a triangular plait or several short, wedge-shaped plaits in the middle. The lower or cutting margin is often more or less serrate (pl. 50, fig. 1, *D. virginialis*, after Schako; pl. 58, fig. 69, *D. acervatus*).

Radula rather broad, with a great number of teeth, 115 to over 150, in each transverse row. The rows are more or less angular in the middle, but not markedly V-shaped (pl. 50, fig. 2, *D. virginialis*, after Schako; pl. 58, fig. 75, *D. acervatus*, inverted).

The lateral teeth are oblique, tricuspid, the ento- and meso-cones more or less united basally; the ectocones become split upon the outer laterals and the marginal teeth. The rhaebidian tooth varies widely, being tricuspid in some, unicuspid in other species (pl. 58, figs. 77, 79, *D. acervatus*; pl. 60, figs. 14, 15, *D. vincentinus*; pl. 60, fig. 16, *D. interpunctus*). In general, the lateral and marginal series of teeth are scarcely differentiated, all the side teeth being practically of one type. Distribution, tropical and subtropical regions of America, living chiefly on plants.

This genus is readily distinguished from *Bulinulus* by the sculpture of the apex (as in pl. 15, fig. 31). *Zaplagius*, *Oxychona*, *Otosotomus*, *Odontostomus*, which have the same apical sculpture, differ in other conchological characters, as well as in dentition. The marginal teeth of *Plectostylus* resemble those of *Drymæus*, but in all other Bulimulid genera the form of the teeth is different. It will readily be understood that since the apical sculpture has rarely been mentioned in descriptions, a number of the species not known to me by specimens are placed in this genus provisionally, from their general resemblance to forms known to belong here. Previous to the discovery that the apical sculpture is correlated with a certain type of jaw and teeth, there was no definite criterion for the classification of the species of *Bulinulus* and *Drymæus*, although von Martens, Crosse and Fischer, W. G. Binney and Pfeffer had recognized that two diverse types of lingual armature were found among the species usually classified as *Bulinulus*.

The dentition deserves, and would well repay, an extended study. In some forms, such as *D. interpunctus* (pl. 60, fig. 16), there are excessively numerous and very minute teeth, in which the basal plate is so thin, and contains so small an amount of conchiolin, that it is scarcely or not visible. The rhachidian tooth has three cusps, the mesocone but slightly larger than the ectocones; and it is often perceptibly asymmetrical. The rows of teeth run *backward* each side of the middle, then turn forward (pl. 50, fig. 2). Radulæ of this type have been found in *D. interpunctus* (see pl. 60, fig. 16), *D. virginialis* (Schako), *D. dormani* (Binney), *palpaloensis* and *sulphureus* (Pfeffer). All of these are thin-shelled species with thin, simple peristome.

A modification of this type is seen in *D. laticinctus*, *immaculatus*, *bahamensis*, etc., in which the single broad cusp of the rhachidian tooth is notched (see Binney, Ann. N. Y. Acad. Sci. III, pl. 12, f. I. H. F.).

In another series the rhachidian tooth has a single rather narrow cusp (pl. 60, figs. 14, 15, *D. vincentinus*). The rows of teeth bend about as in *D. interpunctus*, but to a less extent, and more gradually.

In *D. acervatus* (pl. 58, figs. 75, 77, 79) the basal plates are less indistinct; the rhachidian tooth is tricuspid, the mesocone much longer than the blunt ectocones. The rows of teeth run slightly *backward* from the middle towards the margins, and are without the double situation described above.



In *Liostracus*, *Zaplagius* and *Oxychona* the rows of teeth run obliquely forward from the middle towards the margins, as in the *Orthalicinæ* and most other land snails which have oblique rows.

*Group of D. inæqualis.* N. Argentina to Ecuador.

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| <i>D. abyssorum</i> Orb., xi, 192 ; xiv, 154.  | <i>D. feriatius</i> Rve., xi, 203.           |
| <i>D. bolivarii</i> Orb., xi, 193.             | <i>D. yungasensis</i> Orb., xi, 203.         |
| <i>D. brachystoma</i> Orb., xi, 193.           | <i>D. andai</i> Jouss., xi, 212.             |
| <i>D. marmarinus</i> Orb., xi, 194; xiv, 154.  | <i>D. ochrocheilus</i> Sm., xi, 204.         |
|  | <i>D. cantatus</i> Rve., xi, 205.            |
| <i>D. hygrohylæus</i> Orb., xi, 194; xiv, 154. | <i>D. peelii</i> Rve., xi, 205; xiv, 154.    |
|  | <i>D. v. fordii</i> Pils., xi, 205.          |
| <i>D. coarctatus</i> Pfr., xi, 195.            | <i>D. germaini</i> Anc., xi, 206.            |
| <i>D. schmidtii</i> Pfr., xi, 195.             | <i>D. subeffusus</i> Phil., xi, 217.         |
| <i>coarctatus</i> Rve.                         | <i>D. linostoma</i> Orb., xi, 218.           |
| <i>D. xanthostoma</i> Orb., xi, 196.           | <i>D. serratus</i> Pfr., xi, 218.            |
| <i>D. zoographicus</i> Orb., xi, 197.          | <i>D. dacostianus</i> Pils., xi, 219.        |
| <i>D. beyerleanus</i> Hupé, xi, 197.           | <i>lucidus</i> DaCosta.                      |
| <i>D. interpiectus</i> Mart., xi, 198.         | <i>D. baezensis</i> Hid., xi, 219.           |
| <i>D. inæqualis</i> Pfr., xi, 199.             | <i>D. subsimularis</i> Pils., xi, 222.       |
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*marielinus* Poey.  
*floridanus* Pfr.  
*hemphilli* Wright.
- D. hjalmarsoni Pfr., xii, 7.
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- D. bahamensis Pfr., xii, 8.
- D. erubescens Pfr., xii, 9.  
*rufescens* Gray.
- D. immaculatus 'Ad.' Rve., xii, 10.
- D. liliaceus Fér., xii, 10.
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v. haitensis Pils., xii, 12.  
*bahamensis* auct.
- D. virginalis Pfr.  
v. dominicanus Pils., xii, 12.
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v. flavotinctus Pils., xii, 18.
- D. imperfectus Gupp., xii, 19.  
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     *gabbianus* W. G. B.  
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*Group of D. totonacus.*

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*D. totonacus* Streb., xii, 71.  
*D. dominicus* Rve., xii, 72.  
*D. albostriatus* Streb., xii, 72.  
*D. championi* Mart., xii, 73.

- D. emeus* Say, xii, 73.  
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     *palpaloensis* Streb.  
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- D. hondurasensis* Pfr., xii, 88.  
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     *v. subfloccosus* Pils., xii, 90.



Section *Stenostylus* Pilsbry, 1898. Peru to Colombia.

- |                                 |                             |
|---------------------------------|-----------------------------|
| D. kochi Pfr., xi, 314.         | D. meleagris Pfr., xi, 315. |
| D. guttula Pfr., xi, 314.       | D. colmeiroi Hid., xi, 316. |
| D. goudoti Pet., xi, 314.       | D. tapadoides Ph., xi, 317. |
| D. troscheli Phil., xi, 314.    | D. ignobilis Ph., xi, 317.  |
| D. nigrolimbatus Pfr., xi, 315. |                             |

Subgenus *LEIOSTRACUS* Alb., 1850.

ALBERS, Die Hel., 1850, p. 156. PILSBRY, Manual xii, p. 90.

Perforate, ovate pyramidal shells with the brilliant and usually banded or streaked surface of *Drymæus*; but the nepionic shell has extremely minute spiral striae and occasionally some slight vertical wrinkles.

The jaw (of *D. perlucidus*) is like that of *Drymæus*. The radula (pl. 58, fig. 78) has brace-shaped (—) transverse rows running forward from middle to margins, and with *comparatively few teeth in a row*, the formula of *D. perlucidus* being 19.9.19.19. The centrals have a single rather wide cusp shorter than the basal-plate. The laterals have a very broad, rounded main cusp and a well developed ectocone. The main cusp becomes emarginate on the marginals, and finally bifid, and the ectocone also splits (pl. 58, fig. 76, *D. perlucidus*.) The mantle is green in this species.

*Leiostracus* differs widely from *Drymæus* in its diverse, probably degenerate, apical sculpture, in the *reduced number of teeth*, and the entire, rounded cusps of the laterals. In all true *Drymæus* the lateral teeth are trienspid. These differences will probably make it advisable to raise the group to generic rank; but until the radula of the type species, *D. vittatus*, is examined, I prefer to treat it as a subgenus of *Drymæus*; the natural position of *Leiostracus* being between *Drymæus* and *Zaplagius*. The species are all Brazilian.

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|--------------------------------------|------------------------------------|
| D. vittatus Spix, xii, 91.           | D. vimineus Moric., xii, 95.       |
| <i>H. coxearana</i> Moric.           | D. manoeli Moric., xii, 96.        |
| <i>H. caxoeirana</i> Moric.          | <i>coxiranus</i> P. & M.           |
| <i>B. candidus</i> Gray.             | D. cinnamomeolineatus Moric., xii, |
| <i>B. omphalodes</i> Mke.            | 97.                                |
| D. obliquus Rve., xii, 93; xiv, 163. | D. perlucidus Spix, xii, 98.       |
| <i>jeffreysi</i> Pfr.                | <i>opalinus</i> Sowb.              |
| D. clouei Pfr., xii, 94.             | <i>H. angulosa</i> Fér.            |
| D. onager Bk., xii, 94.              |                                    |
| <i>zebra</i> Spix.                   |                                    |
| v. subtuszonata Pils., xii, 95.      |                                    |

## Genus BOTHRIEMBRYON Pilsbry, 1894.

Manual XIII, p. 1. *Liparus* of authors, not of Albers or Olivier.

The shell in this group is similar to that of *Bulimulus*. The soft anatomy is known by the work of Deshayes and Semper on *B. melo*, and of Hedley on *B. mastersi*, *tasmanicus* and *spenceri*.

The triangular kidney is as short as the pericardium in *B. melo*. The genital system in all the species examined, shows a long, slender penis, corrugated inside and without papilla, tapering into an epiphallus above, which receives the vas deferens midway and the retractor muscle at the apex (*melo*), or has a very delicate retractor attached to the membrane enveloping the vagina (*spenceri*), or is apparently without retractor, and ends in a long, coiled flagellum (*tasmanicus*). The oval spermatheca is upon a duct about as long as the oviduct, and attached to its enveloping membrane (pl. 51, fig. 20, *B. melo*, after Semper).

The jaw is thin and delicate, composed of 11 (*melo*), 15 (*mastersi*), 16 (*spenceri*), 32 (*tasmanicus*) plaits, which denticulate the lower or both edges and converge obliquely, leaving a triangular plait in the middle (pl. 60, fig. 10, *B. tasmanicus*, after Hedley).

The radula has 29.10.1.10.29 teeth in *B. melo*, 40.5.1.5.40 in *B. mastersi*, 32.15.1.15.32 in *B. spenceri*, 84.5.1.5.84 in *B. tasmanicus*. The teeth have squarish basal plates and pointed cusps of the ordinary Helicid form, the centrals with the mesocone shorter than or about as long as the basal plate below it, ectocones small (*melo*, *spenceri*), or wanting (*mastersi*, *tasmanicus*). The lateral teeth have longer mesocones and distinct ectocones. The marginals have the mesocone or both mesocone and ectocone split in some species, while in *spenceri* they remain simple, and "to the remotest marginals the mesocone dominates the ectocone."

Notwithstanding its isolation, this genus differs from South American *Bulimulinae* in minor characters only, so far as we now know. The radula is of undifferentiated type, like that of *Bulimulus*, but the jaw has converging plaits as in *Drymaeus Placostylus*, etc., and unlike *Bulimulus*. The genital system is identical with that of *Bulimulus* and *Drymaeus* in *B. melo*, and also in the other species examined, except for the somewhat conflicting statements regarding the apex of the penis and its retractor muscle, which call for re-examination. The kidney is strictly Bulimuline, according to Semper; but the ancient and probably not very exact figure in the *Revue Animal*

shows a pallial system somewhat unlike known American Bulimuli, in the partial rotation of the pericardium and kidney. A tendency toward that condition exists however in some forms of *Drymaeus*. I regret that want of material prevents a new examination of the pallial organs and retractor muscles.

*Bothriembryon* inhabits South Australia and Western Australia, with a single species in Tasmania.

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|--|---------------------------------------|
| B. dux Pfr., xiii, 3.                    | B. physodes Mke., xiii, 234.          |
| B. inflatus Lam., xiii, 3.               | <i>physoides</i> Reeve., xiii, 9.     |
| ? <i>costulata</i> Fér.                  | B. brazieri Ang., xiii, 10.           |
| <i>melones</i> Fér.                      | v. <i>humilis</i> Pils., xiii, 10.    |
| <i>ovum</i> Dh.                          | B. gratwicki Cox, xiii, 11.           |
| v. <i>melo</i> Q. G., xiii, 5.           | B. onslowi Cox, xiii, 11.             |
| v. <i>castaneus</i> Dh., xiii, 5.        | v. <i>minor</i> Pils., xiii, 12.      |
| v. <i>maculiferus</i> Pils., xiii, 5.    | <i>hurtogensis</i> Kobelt, xiv, 166.  |
| v. <i>conspira</i> Pils., xiii, 5.       | B. leeuwinensis Sm., xiii, 13.        |
| B. martensi Kob., xiv, 166.              | B. indutus Mke., xiii, 13.            |
| B. spenceri Tate, xiii, 6.               | ? <i>rhodostoma</i> Gray.             |
| B. kingii Gray, xiii, 7.                 | v. <i>pallidus</i> Tate, xiii, 15.    |
| <i>trilineata</i> Q. G.                  | B. bulla Mke., xiii, 15.              |
| <i>sayi</i> Pfr.                         | B. baconi Bens., xiii, 16.            |
| <i>quoyi</i> Cox.                        | B. angasianus Pfr., xiii, 16.         |
| v. <i>solidus</i> Pils., xiii, 9.        | B. mastersi Cox, xiii, 17.            |
| v. <i>naturalistarum</i> Kob.,           | B. gunni Sowb., xiii, 18.             |
| Conch. Cab., p. 781.                     | <i>tasmanicus</i> Pfr.                |
| v. <i>maxwelli</i> + <i>Braz.</i> , Kob. | v. <i>brachysoma</i> Pils., xiii, 19. |

#### Genus PLACOSTYLUS Beck, 1837.

Manual XIII, p. 19. Type *P. fibratus* Martyn.

Chiefly large shells, the ground living species brown, often thick and ponderous, the arboreal species thinner and frequently variegated with green or white. Nepionic whorls thimble-punctate when unworn. Aperture and lip commonly orange-red.

The kidney (in *P. shongii*, pl. 51, fig. 15) is short and triangular, as long as the pericardium, with closed ureter and gut-ureter. The heart lies obliquely to the long axis of the lung. The capacious pulmonary vein bears no large branches. The first branch of the pericardial vein arises close to its origin, and is almost as conspicuous as the pulmonary vein, from which it is separated by the very long

first vein of the vena cava. The vena cava bears a second large vein which parts the two branches of the first branch of the pericardial vein. The general reticulation is faint, the veins mentioned having no large branches.

The free retractor muscles (of *P. shongii*, pl. 54, fig. 41, nat. size) are arranged as in the American *Bulinulidæ*. The right ocular retractor band arising from the face of the columellar muscle.

The genital system (pl. 51, fig. 23, *P. shongii*) is characterized by the very large size of the fleshy penis, at the distal end of which the short retractor muscle is inserted, its distal termination being on the lung floor. There is no internal papilla, but the walls are corrugated above (fig. 24), and bear a pilaster below (fig. 25). The vas deferens is imbedded in the superficial integument of the penis nearly to the base of the latter. The vagina is moderately long. The duct of the spermatheca is short, the uterus being fully double its length. A muscle binds the spermatheca to the oviduct. In *P. elobatus* (pl. 51, fig. 22, after Semper) Semper found a similar system, except that the penis and spermatheca duct are much shorter. *P. seemanni* and *P. fulguratus* have similar genitalia, all three being Fijian species. In *P. porphyrostomus* Fischer found the genitalia about as in *shongii*, except that the vagina and spermatheca with its duct are shorter. In *P. scarabus* the penis is shorter (J. de C., 1871, pl. 7).

The jaw is strongly arcuate, thick and brown, composed of many narrow plaits, converging toward the median line, the median plate wedge-shaped.

The radula is of the normal Helicid type. The central teeth have a strong mesocone, and small ectocones or none. The laterals are similar, but asymmetrical without an entocone. They gradually change to marginals by splitting of the mesocone. The radula of *P. shongii* I examined has about 20 lateral teeth on each side, followed by about 10 well-developed marginals, bordered by perhaps a dozen or more small irregularly developed and probably functionless marginal teeth. Semper found 120 to 158 teeth in a row in the Fijian species (Pl. 60, fig. 13, *P. fulguratus*, after Semper). There is a perceptible though not great difference in form between the marginal teeth of the Placostyles of Fiji and those of New Caledonia, Lord Howe Island and New Zealand.

*Placostylus* is typically Bulimuline in nepionic sculpture, teeth, jaw, kidney and free muscles. It varies from most American genera

in the shortening of the duct of the spermatheca, and the enlargement and evident functional importance of the first branch of the pericardial vein. The latter is well developed, however, in the American genus *Macrodontes*.

Section *Plucostylus* s. str.

(Species of New Zealand.)

- |                                    |   |
|------------------------------------|---|
| <i>P. shongii</i> Less., xiii, 22. | <i>v. novoseelandicus</i> Pfr., xiii, 24. |
| <i>borinus</i> auct.               | <i>neozelandicus</i> Hutton.              |
| <i>auris-bovina</i> Petit.         | <i>v. candidus</i> Crosse, xiii, 25.      |
| <i>hongii</i> Suter, xiii, 235.    |   |

(Species of Lord Howe Island.)

- |  |                                       |
|--|---------------------------------------|
| <i>P. bivaricosus</i> Gask., xiii, 25. | <i>v. etheridgei</i> Braz., xiii, 26. |
| <i>v. eunienlinsulæ</i> Cox, xiii, 26. | <i>v. solidus</i> Eth., xiii, 27.     |

(Species of New Caledonia and the Loyalty Is.)

Group of *P. bavayi*.

- |   |                                      |
|---|--------------------------------------|
| <i>P. eddystonensis</i> Pfr., xiii, 30. | <i>P. curtus</i> Cr., xiii, 33.      |
| <i>hienguenensis</i> Crosse.            | <i>layardi</i> Kob.                  |
| <i>serraini</i> Euthyme.                | <i>P. savi</i> Cr., xiii, 33.        |
| <i>P. bavayi</i> C. & M., xiii, 31.     | <i>P. rossiteri</i> Braz., xiii, 34. |
| <i>v. dupuyi</i> Kob., xiii, 31.        |                                      |
| <i>P. bondeensis</i> C. & S., xiii, 32. |                                      |
| <i>v. edentulus</i> C. & S., xiii, 32.  |                                      |

Group of *P. fibratus*.

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|--|--|
| <i>P. alexander</i> Cr., xiii, 35.                 | <i>P. fibratus</i> Martyn, xiii, 39, 235.            |
| <i>v. procerula</i> , <i>ouagapensis</i> ,         | <i>B. alboroseus</i> , <i>bulbulus</i> , <i>car-</i> |
| <i>crassus</i> , <i>leucostoma</i> , <i>nigri-</i> | <i>bonarius</i> , <i>necouensis</i> , <i>in-</i>     |
| <i>cans</i> Crosse, xiii, 36;                      | <i>fundibulum</i> , <i>superfasciatus</i> ,          |
| <i>patulus</i> Kob., xiii, 236.                    | <i>patens</i> , of Gassies; <i>B. f.</i>             |
| <i>P. corpulentus</i> Gass., xiii, 37.             | <i>pallidula</i> Crosse; <i>Voluta</i>               |
| <i>P. abbreviatus</i> Gass., xiii, 37.             | <i>australis</i> Dillw.; <i>H. auris-</i>            |
| <i>P. kanalensis</i> Cr., xiii, 38.                | <i>borinus</i> Fér.; <i>Auricula</i>                 |
| <i>v. tchiaoensis</i> Kob., xiii, 38.              | <i>aurantiaca</i> Schum.; <i>B.</i>                  |
| <i>thioensis</i> Cr.                               | <i>bootis</i> Mke.                                   |
| <i>v. subeffusus</i> Kob., xiii, 39.               | <i>v. pinicola</i> Gass., xiii, 42.                  |

- v. bovinus Brug., xiii, 42.  
 v. bairdii Rve., xiii, 42.  
 v. peculiaris Kob., xiii, 42.  
 v. leucolenus Cr., xiii, 42.  
 v. danieli Cr., xiii, 43.  
 v. knoblauchii Kob., xiii, 43.  
 v. insignis Pet., xiii, 43.  
 v. ouensis Gass., xiii, 43.  
 v. imbricatus Gass., xiii, 44.  
 v. lalannei Gass., xiii, 44.  
 v. grammicus Cr., xiii, 44.  
 v. crassus 'Lay.' Kob., xiii, 45.  
     *aurismidæ* Rve.  
 v. ventricosus Kob., xiii, 45.  
 v. ovalis Kob., xiii, 45.  
 v. ovata Cr., xiii, 45.  
 v. edwardsianus Gass., xiii, 45.  
 v. strigatus Pils., xiii, 46.  
 v. mareanus Cr., xiii, 46.  
     *turrita* Kob.  
     *garema* Pfr.-Cless.  
 P. arenosus Gass., xiii, 46.  
 P. faleicula Gass., xiii, 46.  
 P. ouveanus 'Dotz.' Mss., xiii, 47.  
     *sinistrorsus* and *scalaris* Crosse.  
     *æsopeus* Gass.  
     v. lifouanus Cr., xiii, 48.  
     v. albus Cr., xiii, 48.  
 P. souvillei Morel., xiii, 48.  
     *eximeus* Alb.  
 P. lamberti Gass., xiii, 49.  
 P. boulariensis Sowb., xiii, 50.  
 P. guestieri Gass., xiii, 51.  
     v. gatopensis Cr., xiii, 51.  
     v. confusus Pils., xiii, 52.  
     *cicatricosus* Kob.  
     v. orientalis Kob., xiii, 52.  
     v. rhinocheti Kob., xiii, 52.  
 P. senilis Gass., xiii, 53.  
     v. minor Kob., xiii, 53.  
     v. subsenilis Gass., xiii, 53.  
 P. buccalis Gass., xiii, 53.  
 P. goroensis Souv., xiii, 54.  
 P. arenosus Gass., xiii, 46.

Group of *P. porphyrostomus*.

- P. submariei Souv., xiii, 55.  
     v. *abbreviata* Souv.  
 P. mariei C. & F., xiii, 55.  
     v. simplex Cr.; v. curtus, Gass.  
 P. neckliaiensis Kob., xiii, 56.  
 P. porphyrostomus Pfr., xiii, 57.  
     *lessoni* Pet.  
     *auris-bovina* Rve.  
     v. singularis Morel., xiii, 58.  
     v. debeauxi Gass., xiii, 58.  
     v. umbilicatus Kob., xiii, 236.  
 P. monakensis Cr., xiii, 58.  
     *dantzenbergi* Marie.  
 P. duplex Gass., xiii, 59.  
     v. major Gass.  
 P. caledonicus Pet., xiii, 60.  
     v. edentulus Braz., xiii, 61.  
 P. poyensis Kob., xiii, 61.  
     v. goyettensis Cr., xiii, 62.  
 P. pseudocaledonicus Montr., xiii, 62.  
     Forms intermedius Cr., subulatus Cr. (*nigra* Gass.), dentatus Gass., palus Gass., rufus Gass., incertus Cr., hybridus Kob., pouenanus Kob.  
     v. chrysochilus Cr., xiii, 64.  
     *gaudryanus* Gass.  
     v. annibal Souv., xiii, 64.  
     v. saxtoni Kob., xiii, 65.  
 P. scarabus Alb., xiii, 65.  
     v. tanouensis Cr., xiii, 66.  
     v. smithii Kob., xiii, 66.  
     v. goulvainensis Kob., xiii, 67.

*Species of the New Hebrides.*

- P. salomonis* Pfr., xiii, 69.      *P. heterostylus* Pils., xiii, 72.  
*P. fuliginus* Pfr., xiii, 70.      *P. alienus* Pils., xiii, 72.

*Species of New Guinea.*

- P. remotus* Hedley, xiii, 76.

*Species of the Solomon Is.*Section *Placocharis* Pilsbry, 1900.

- Man. Conch., xiii, p. 21, 79.    Type *P. macgillivrayi*.    Solomon Is.

Group of *P. macgillivrayi*.

- P. founaki* H. & J., xiii, 79.      *P. calus* Smith, xiii, 83.  
*hombroui* Cr.      *P. macgillivrayi* Pfr., xiii, 84.  
v. *paletuvianus* Gass.      *P. palmarum* Mss., xiii, 85.  
*rhizophorarus*, etc., Gass.      v. *minor* Kob., xiii, 86.  
*P. kreftii* Cox., xiii, 81.      *P. strangei* Pfr., xiii, 87.  
*P. guppyi* Sm., xiii, 82.      *P. stutchburyi* Pfr., xiii, 88.  
*P. macfarlandi* Braz., xiii, 83.      v. *mendanae* Kob., xiii, 89.  
*brodiei* Braz.      *P. (?) coxi* Pse., xiii, 90.

Group of *P. scotti*.

- P. scotti* Cox, xiii, 90.      *P. hargravesi* Cox, xiii, 93.  
*P. uliginosus* Heimb. Kob., xiii,      v. *heimburgi* Kob., xiii, 93,  
91.      236.  
v. *hobsoni* Cox, xiii, 237.

Section *Aspastus* Albers, 1850.

- Man. Conch., xiii, p. 94.    Type *P. miltocheilus*.    Solomon Is.  
*P. miltocheilus* Rve., xiii, 94.      v. *albolabris* Braz., xiii, 95,  
v. *stramineus* Braz., xiii, 95.      236.  
v. *minor* Braz., xiii, 95.      *P. sellersi* Cox, xiii, 95.

Section *Eumecostylus* Albers, 1860.

- Man. Conch., xiii, p. 96.    Type *P. cleryi*.    Solomon Is.  
*P. cleryi* Recl., xiii, 96, 236.      *P. sanchristovalensis* Cox, xiii, 97.

*Species of the Fiji Is.*Section *Euplacostylus* Crosse, 1875.

- Man. Conch., xiii, p. 99.    Type *P. seemanni*.    Fiji Is.  
*P. seemanni* Dohrn, xiii, 100.      *P. koroensis* Garr., xiii, 101.  
*P. kantavuensis* Cr., xiii, 101.

Section *Callistocharis* Pilsbry, 1900.

- Man. Conch., xiii, pp. 21, 102. Type *P. malleatus*. Fiji Is.  
*P. paeteli* Kob., xiii, 102. *P. ochrostoma* Garr., xiii, 108.  
*moussoni* Graeffe. v. *rambiensis* Garr., xiii, 108.  
*P. garretti* Pils., xiii, 103. *P. pfeifferi* Kob., xiii, 109.  
*P. graeffei* Cr., xiii, 104. *elobatus* var., Pfr.  
*colubrinus* Mouss. *P. vitiensis* Garr., xiii, 110.  
*moussonii* Graeffe. *P. gracilis* Brod., xiii, 110.  
*P. hoyti* Garr., xiii, 105. *fulguratus* Jay.  
*P. elobatus* Gld., xiii, 105. *eximius* Rve.  
*colubrinus* Pfr. v. *rugatus* Garr., xiii, 112.  
v. *albino* Pils., xiii, 106. v. *crassilabrum* Garr., xiii, 112.  
*P. guanensis* Garr., xiii, 107. *P. malleatus* Jay, xiii, 112.  
*guanensis* Schmeltz. *P. morosus* Gld., xiii, 113.

Section *Leucocharis* Pilsbry, 1900.

- Man. Conch., xiii, pp. 21, 67. Type *P. pancheri*. Soft anatomy unknown. Distribution, New Caledonia and Loyalty Is.  
*P. pancheri* Cr., xiii, 67. *P. loyaltiesensis* Souv., xiii, 68.  
v. *candida* Cr., xiii, 68. *P. porphyrochila* D. & B., xiv, 167.  
v. *rubicunda* Dautz. et Bern.

Section *Pæcilocharis* Kobelt.

- Man. Conch., xiii, p. 73. Type *P. hartmani*. Distribution New Hebrides.  
*P. hartmani* Kob., xiii, 73. *P. francoisi* Mab., xiii, 74.  
*rossiteri* Hartm. *P. turneri* Pfr., xiii, 75.  
*hartmanni* Kob. *P. hebridarum* Mab., xiii, 75.  
*P. bicolor* Hartm., xiii, 74.

Subgenus *Diplomorpha* Ancey, 1884.

- Man. Conch., xiii, p. 114. Type *D. layardi*. New Hebrides.  
*P. layardi* Braz., Hartm., xiii, 115. *P. coxianus* Pils., xiii, 118.  
*P. brazieri* Hartm., xiii, 116. *coxi* Hartm.  
*P. peasei* Cox, xiii, 117. *P. ruga* Hartm., xiii, 119.  
*P. delatouri* Hartm., xiii, 117. *P. bernieri* Hartm., xiii, 119.



## Sub-family ODONTOSTOMINÆ.

This vol., p. 24. As the anatomy of the genera of this group has been discussed in the present volume, and the species described, it would be superfluous to give a summary of them in this place.

The less specialized forms of *Odontostominæ* apparently had a wider geographic range in the past than any living genus of the sub-family. *Hyperaulax*, which is not greatly modified from *Bulimulus*, occurred in the Floridian Oligocene at the time when Florida was not connected with the North American continent, but had a purely Antillean snail-fauna.

The genera are as follows:

Genus MACRODONTES Swains., p. 29.

Genus ANCTUS v. Mart., p. 36.

Genus ODONTOSTOMUS Beck, pp. 38, 169.

Section *Moricandia* Pils. & Van., p. 40.

Section *Bahiensis* Jouss., p. 46.

Section *Cyclodontina* Beck, p. 58.

Section *Odontostomus s. str.*, p. 62.

Subgenus SCALARINELLA 'Doer.' Dohrn, p. 66.

Subgenus SPIXIA Pils. & Van., p. 67.

Subgenus PLAGIODONTES Doer., pp. 92, 171.

Genus HYPERAULAX Pils., p. 102.

Section *Bonnanus* Jouss., p. 103.

Genus TOMIGERUS Spix, p. 105.

Genus ANOSTOMA F. de Waldh., p. 109.

Section *Ringicella* Gray, p. 114.

## Subfamily ORTHALICINÆ.

PILSERY, Manual, xii, p. 99.

Shell imperforate with solid axis, varying from ovate to oblong-conic or pyramidal, the aperture ovate, toothless, columella simple and straight, or twisted or truncate below. Jaw composed of a small number (usually 14 to 20) of wide imbricating plaits. Teeth of the radula very numerous, part or all of them bearing broad gouge-shaped cusps. Cardiac side of the lung plain except near the pneumostome. Genitalia simple except for an appendix on the penis. Oviparous.

A natural group of tropical American snails, chiefly arboreal,

Bulimuline in their main features, but differing from the *Bulimulinæ* in the wholly imperforate shell, the appendix of the penis, developed in no other group of *Bulimulidæ*, the few broad and strongly imbricating plaits of the jaw, and a special modification of the teeth.

*Synopsis of Genera.*

I. Early whorls pitted.

*a.* Shell rather thin, capacious, with large, oblique aperture and simple, thin or somewhat thickened lip and columella, the former not expanded. Genus ORTHALICUS.

*a*<sup>1</sup>. Shell solid, more lengthened, the aperture smaller, vertical or nearly so, the lips thick and blunt, or expanded or reflexed; columella usually with one or two folds.

*s. g. Metorthalicus.*

II. Early whorls smooth, or with some radial wrinkles.

*a.* Shell ovate-conic, usually with coloration of festooned dark stripes, and three equidistant bands. Aperture rather large, ovate and oblique, the lip simple and unexpanded, columella straight or somewhat convex, not truncate below, Vagina and spermatheca duct long.

Genus OXYSTYLA.

*a*<sup>1</sup>. Shell ovate-conic, solid, with ovate aperture, the lip reflexed, expanded, or merely blunt and rather thick. Vagina and spermatheca duct short. Genus PORPHYROBAPHE.

*a*<sup>2</sup>. Shell oblong-conic, with simple, thin-edged, unexpanded lip, the columella usually truncate below, either concave, folded or straight above. Genus LIGUUS.

*b.* Shell white or bright-colored, with rather small apex. Antillean. *s. g. Liguus.*

*b*<sup>1</sup>. Shell dark colored, the columella concave above, abruptly truncate at the base. Colombia.

*s. g. Hemibulimus.*

*b*<sup>2</sup>. Shell strong, the apex obtuse as though cut off, the columella bearing a callous fold above. Colors not vivid. South America. *s. g. Corona.*

The genital system of the *Orthalicinæ* (plate 55) is Bulimuline in its main features, and shows no important differences in the various genera. The atrium is very short. The penis bears an accessory

gland or appendix, usually composed of several lobes in *Oxystyla*, *Liguus*, *Porphyrobaphe* and *Metorthalicus*, but reduced to an annular swelling in *Orthalicus*. The penis is continued in an epiphallus to which the retractor and vas deferens are attached distally. The vagina is quite long, except in *Porphyrobaphe*. The small globose or ovate spermatheca lies near the heart, its duct being very long except in *Porphyrobaphe*, where the duct is much shorter than the uterus.

The kidney is small and triangular, as short as the pericardium, as in all *Bulinulidæ*. The lung is much lengthened, with a large, straight pulmonary vein with only very small branches. The pericardial vein is small, and gives forward but one large branch. Only the first, or right main branch of the anterior vena cava is well developed. The minor reticulation is confined to the intestinal side of the lung, and the anterior extreme of the opposite side, between the base of the first main branch of the vena cava and the end of the pulmonary vein; the rest of the cardiac side being free from visible reticulation (pl. 53, fig. 34, *Oxystyla undata jamaicensis*).

The free muscles resemble those of *Bulinulus* in general arrangement. The pharyngeal retractor unites at its proximal end with the left tentacular band, although both are free almost throughout. The pedal retractors are strongly developed, branching from both the right and left bands. The right tentacular retractor arises from the anterior face of the columellar muscle (pl. 54, fig. 36, *Oxystyla undata jamaicensis*).

The jaw (pl. 60, figs. 17, 18), is composed of a solid basal layer upon which the wide, imbricating plates of the anterior face are superposed. These plates seem to be free at their outer edges, which converge below towards the median line, but they are covered by a transparent outer layer, which is more or less costate vertically in some forms. The edges of the ribs alone are visible, by transmitted light, as in pl. 60, figs. 17, 18. The central plate may be either triangular or irregularly pentagonal, with the point downward.

The radula is very broad, with 170 to over 200 teeth in a transverse row, the rows widely V-shaped. The teeth have square basal plates, which in the median portion of the radula bear very broad, rounded or truncate cusps, longer than the basal plates and projecting beyond it on the sides. This cusp is to be regarded as compound, being composed of completely concreescent ento-meso- and ecto-cones

(pl. 56, fig. 58). Towards the sides a small ectocone gradually makes its appearance, becoming somewhat conspicuous on the outer marginal teeth, and the entocone is usually indicated by a slight notch in the cusp (pl. 56, fig. 57, 53).

This type of teeth resembles the *Zaplagius* type superficially, but differs fundamentally in that the ectocone is united with the mesocone, while in *Zaplagius* it is always distinct.

The broad, shovel-shaped type of cusp described above is sometimes replaced on the median and a few adjacent lateral teeth by long, lanceolate cusps. This modification has been observed in *Lignus virgineus*, L. (*Hemibulinus*) *magnificus*, *Orthalicus sultani* and *atramentarius*, *Oxystyla ferussaci* and *princeps*, though some individuals of the latter have the normal type of teeth. In my opinion, these lanceolate teeth have been modified from the rounded type, secondarily assuming a pointed shape; this view being based upon the general law of tooth-changes set forth in Vol. IX, p. xiii. The species of various genera possessing such teeth are unrelated, and have acquired them clearly by a parallel process. In *Oxystyla princeps*, as Strebel & Pfeffer have shown, the form of the cusps is not a constant specific character. The same is true of *Lignus*.

#### Genus OXYSTYLA Schlüter, 1838.

Vol. xii, p. 101. Synonyms are *Zebra* SHUTTL., 1856, *Orthalicus* Martens, 1893, and *Orthalicus* of writers on North American species.

While the other genera are restricted in distribution, *Oxystyla* extends throughout the tropical and subtropical regions of both Americas, though in South America the species are more numerous and diversified.

The kidney and lung (pl. 53, fig. 34, *O. nudata jamaicensis*), retractor muscles (pl. 54, fig. 36, *O. n. jamaicensis*) and jaw have been treated of under the subfamily head. The radula has about 100.1.100 teeth in *O. n. jamaicensis* (pl. 56, figs. 57, 58), the cusps being broad and rounded as usual. Most of the species investigated have similar teeth. In some forms of *O. princeps* and *O. ferussaci* (pl. 59, fig. 7, after Strebel) the middle and some adjacent lateral teeth have lanceolate cusps. When this is the case, the number of teeth so modified was found to be unequal on the two sides.

The jaw (pl. 60, fig. 18, *O. longa*) has been described above. The number of plaits varies in different species.

The genitalia (pl. 55, fig. 42, *O. princeps*, fig. 44, *O. n. jamaicensis*; fig. 46, *O. pulchellus*) are characterized by the very long duct of the spermatheca, both penis and vagina being of moderate length. The penis always bears a small accessory gland or appendix, which is usually parted in two lobes, which are subdivided in some forms.

*Antillean Species, Trinidad to S. Florida.*

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|-----------------------------------|--|
| <i>O. undata</i> Brug., xii, 105. | <i>v. jamaicensis</i> Pils., xii, 107. |
| <i>zebra</i> auct.                | <i>v. reses</i> Say, xii, 109.         |
| <i>A. undulata</i> Gldg.          | <i>v. floridensis</i> Pils., xii, 110. |

*Species of Mexico and Central America.*

- |   |  |
|---|--|
| <i>O. princeps</i> Brod., xii, 113.     | <i>O. zonifera</i> Streb., xii, 123.     |
| <i>v. trifracta</i> Pils.               | <i>v. nobilis</i> Rolle. xiv, 164.       |
| <i>v. crossei</i> Mart.                 | <i>O. livida</i> Mart., xii, 124.        |
| <i>v. fischeri</i> Mart.                | <i>O. maculæ</i> Mart., xii, 125.        |
| <i>v. elegans</i> Rolle. xiv, 164.      | <i>O. longa</i> Pfr., xii, 126.          |
| Subsp. <i>deceptor</i> Pils., xii, 116. | <i>v. strebeli</i> Pils., xii, 128.      |
| <i>obductus</i> auct.                   | <i>v. boucardi</i> Pfr., xii, 128.       |
| <i>O. livens</i> Shutt., xii, 118.      | <i>v. oldeana</i> Mart., xii, 129.       |
| <i>O. ferussaci</i> Mart., xii, 119.    | <i>O. leucochilus</i> F. & C., xii, 129. |
| <i>v. tricineta</i> Mart., xii, 120.    | <i>O. ponderosa</i> Streb., xii, 130.    |
| <i>O. melanocheilus</i> Val., xii, 122. | <i>O. decolor</i> Streb., xii, 131.      |

*South American Species.*

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|--|--|
| <i>O. obducta</i> Shutt., xii, 134.      | <i>O. mars</i> Pfr., xii, 143.           |
| <i>O. pulchella</i> Spix, xii, 135.      | <i>O. varia</i> Mart., xii, 144.         |
| <i>v. prototypus</i> Pils., xii, 137.    | <i>B. phlogerus</i> auct.                |
| <i>O. maracaibensis</i> Pfr., xii, 137 ; | <i>A. flogera</i> P. & M.                |
| xiv, 164.                                | <i>O. phlogera</i> Orb., xii, 145 ; xiv, |
| <i>f. imitator</i> Pils., xii, 140.      | 165.                                     |
| <i>v. subpulchella</i> Pils., xii, 141.  | <i>O. macandrewi</i> Sowb., xii, 147.    |
| <i>O. fulvescens</i> Pfr., xii, 141.     | <i>O. bensoni</i> Rve., xii, 147.        |
| <i>O. isabellina</i> Mart., xii, 142.    |  |
| <i>O. bifulgurata</i> Rve., xii, 143.    |  |
| <i>Z. fulgur</i> Mill.                   |  |

Genus PORPHYROBAPHE Shutt., 1845.

Manual xii, p. 149. Shell resembling *Oxystyla*, but more solid, with the peristome thick and blunt or reflexed. The nepionic shell is smooth, not pitted. Type *P. iostoma*.

Jaw (of *P. iostoma*, according to Fischer) composed of 19 plaits. Radula with 85.1.85 teeth, like those of *Oxystyla*. Genitalia (pl. 55, fig. 45, after Fischer) with the penis and vagina short, the gland or appendix of the penis large and lobed. The duct of the spermatheca is about half the length of the oviduct.

This genus differs from *Oxystyla* chiefly in the shortness of the spermatheca duct and vagina, and the thick or blunt lip of the shell. Distribution, northwestern Peru to Colombia.

*Group of P. iostoma.*

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|--|--|
| <i>P. iostoma</i> Sowb., xii, 150.     | <i>P. saturnus</i> Pfr., xii, 153.       |
| <i>phasianella</i> Val.                | <i>P. flori</i> Jouss., xiv, 164.        |
| v. <i>bilabratu</i> s Pils., xii, 152. | <i>saturnus</i> and <i>satuanus</i> Pfr. |
| <i>P. integer</i> Pfr., xii, 153.      |  |

*Group of P. irroratus.*

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|---------------------------------------|--|
| <i>P. irroratus</i> Rve., xii, 155.   | <i>P. grevillei</i> 'Sow.' Pfr., xii, 156. |
| v. <i>elongata</i> Mill., xii, 156.   | <i>P. iris</i> Pfr., xii, 157.             |
| v. <i>minor</i> Mill., xii, 156.      | <i>wallisianus</i> Mouss.                  |
| <i>P. subirroratus</i> DaC. xiv, 163. |  |

*Group of P. dennisoni.*

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|--|------------------------------------|
| <i>P. dennisoni</i> Rve., xii, 158.    | ? <i>P. victor</i> Pfr., xii, 160. |
| v. <i>marmatensis</i> Pils., xii, 159. |                                    |
| v. <i>obscurata</i> Mss., xii, 159.    |                                    |

Genus LIGUUS Montfort, 1810.

Manual xii, p. 161. Long-conic, smooth shells, white, usually variegated in bands or streaks with pink, green or yellow, cuticle inconspicuous or absent; outer lip simple, not expanded; columella usually truncate below, sometimes continuous with the basal lip. The typical group inhabits the Greater Antilles, subgenera occurring in northern South America. The species so far as known are arboreal.

The mantle-edge (of *L. fasciatus*) bears two conspicuous flange-like lobes, one dorsal, the other along the left margin, and separated from the neck-lobe by a narrow notch. The kidney is short and triangular, with completely closed secondary ureter, as in *Oxystyla*. The reticulation of the lung is substantially as in *Oxystyla*, except that the first branch of the pericardial vein is longer, about as long as the pulmonary vein. The venation of the cardiac side of the lung is weak and sparse.

The genital system resembles that of *Oxystyla*, except that the appendix is decidedly larger, though of the same character. The penis retractor muscle is inserted on the floor of the lung. The duct of the spermatheca is as long as the oviduct. The right eye retractor passes between male and female branches of the genitalia.

The jaw (pl. 60, fig. 17, *L. fasciatus*, Miami, Fla.) is similar to that of *Oxystyla*, composed of 16 plates, the median one small and triangular.

The radula is very broad, as in other *Orthalicinæ*, with broadly V-shaped rows of teeth. The teeth are somewhat less numerous than in *Oxystyla*, *L. fasciatus* having from 76.1.76 in a specimen I counted, to 69.1.69 according to Binney. The same author found 40.1.40 teeth in *L. virgineus*. The teeth are closely crowded near the middle of the radula (fig. 23), much more separated near the margins (fig. 23). The cusps of the central and first lateral teeth of *L. fasciatus* are elongate and pointed on the younger (posterior) end of the radula of a specimen from Miami, Fla. (pl. 61, fig. 22); over the median, functional portion of the radula the cusps are more obtuse and rounded (pl. 61, fig. 23); and anteriorly still more so. The laterals become wider, with a much broader, obtuse cusp; the ectocone, at first indicated by a slight sinuation, gradually becoming separated from the mesocone on the outer portions of the radula (pl. 61, fig. 23, teeth 67-69). The entocone is likewise indicated by a more or less pronounced notch on the outer teeth. In a radula of the same species, from Cardenas, Cuba, the central and lateral teeth are more obtuse, and Binney so figures them. In *L. virgineus* the central and first two lateral teeth were found to have long and somewhat pointed cusps (pl. 56, fig. 56, after Binney, central with 5 adjacent laterals, and the 39th and 40th teeth).

*L. virgineus* is from Haiti, the others from Cuba; *fasciatus* occurring also in southern Florida and Cozumel Island, off Yucatan.

*L. virgineus* L., xii, 162.

*A. virginiae* Blv.

*A. vexillum* Humph.

*A. emarginata* Swains.

*Ch. vittata* Humph.

*Helix regina* Bowd., xiv, 165.

*L. poeyanus* Pfr., xii, 166.

*L. blainianus* Poey, xii, 174.

*L. fasciatus* Müll., xii, 166.

*B. vexillum* Brug., *A. pallida*

and *crenata* Swains., *A. anais*

Less., *A. lineata* Val., *A.*

*lutea* Ant., *A. murrea* Rve.,

*A. picta* Rve., *H. hepatica*

Bolt., *A. solida* Say.

## Subgenus CORONA Albers, 1850.

A South American group of rather large, solid, lengthened species, either dextral or sinistral, the columella more or less truncate or excised at base, twisted and bearing a callous fold above. Soft anatomy unknown. Type *L. regina*, Fér.

*Corona* is considered by Mr. E. A. Smith to be more nearly related to the group of *Metorthalicus atramentarius* than to *Lignus*. Cf. Proc. Malac. Soc., v, p. 170.

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|--|---------------------------------------|
| <i>L. regina</i> Fér., xii, 177.       | <i>L. incisus</i> Hupé, xii, 179.     |
| <i>A. melastoma</i> Swains.            | <i>L. regalis</i> Hupé, xii, 180.     |
| <i>A. melanostoma</i> Gray.            | <i>regina</i> auct.                   |
| <i>O. rex dextrorsus</i> Bk.           | <i>v. lotoisianus</i> Hupé, xii, 183. |
| <i>L. perversus</i> Swains., xii, 178. | <i>L. pfeifferi</i> Hid., xii, 146.   |
| <i>O. rex sinistrorsus</i> Bk.         | <i>v. gracilis</i> E. A. Sm., 1902.   |

## Subgenus HEMIBULIMUS Martens, 1885.

Fusiform, dark-colored, with obtuse apex, the first whorl finely wrinkled. Columellar margin concave, distinctly truncated at base. The jaw (pl. 56, fig. 50) is composed of 13 imbricating plates, the median one reaching the basal margin. Radula with 62.2.1.2.62 teeth. The centrals are much lengthened, with a long, lanceolate mesocone and vestigial side cusps. Two laterals on each side are similar, but asymmetrical. The rest of the teeth are short and broad, with quadrate base, very wide, short cusps, and a minute ectocone. The outermost marginals become tricuspid (pl. 56, figs. 51, 52, 53).

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|--------------------------------------|--------------------|
| <i>L. magnificus</i> Pfr., xii, 185. | Andes of Colombia. |
| <i>v. excisus</i> Mart., xii, 185.   |                    |

## Genus ORTHALICUS Beck, 1837.

Man. Conch. xii, p. 186. Strebel & Pfeiffer, Beitr. Mex. Land-u. Süßwasser-Conchyl., Theil v, p. 2 (anatomy of *O. sultana*). W. G. Binney, Ann. Lyc. N. H. of N. Y. xi, p. 38 (anatomy).

In *O. sultana* from Guiana, Strebel found the right neck-lobe of the mantle strongly developed; the left forms a continuous rim around the entire mantle. The genital system (pl. 55, fig. 43) has the general characters of other genera of the sub-family, except that the appendix of the penis is represented by a circular swelling. The latter was not noticed by Binney, who examined a specimen from Marañon, Peru.



The jaw is composed of 15 plaits, the median ones not reaching the lower margin. The radula (pl. 56, fig. 55, *O. sultana* from Marañon, after Binney) has over 108.1.108 teeth. The central and inner three laterals on each side have rather narrow basal-plates, and long, lanceolate cusps. The rest of the teeth are wide, with broad, short, rounded cusps, as usual in the subfamily.

- O. sultana* Dillw., xii, 188.      *O. meobambensis* Pfr., xii, 191.  
*H. gallina sultana* Chemn.      *O. trullisatus* Sh., xii, 191.  
*O. sultana* Beck.  
*A. pavonina* Spix.

#### Subgenus METORTHALICUS Pils.

The anatomy of *O. atramentarius* has been examined by Strebel and Pfeffer. The lower portion of the penis is much swollen; it bears a large appendix, which is slightly lobed distally (pl. 55, fig. 48, 47, section of penis and appendix, f. 49, appendix). The median plaits of the jaw are markedly triangular. The radula (pl. 56, fig. 54) has the central tooth, three laterals on one side and four on the other, of the narrow, lanceolate shape which occurs in *O. princeps*, *O. sultana*, *Liguus virgineus* and *magnificus*; the other teeth being of the usual broadly rounded form.

#### Group of *O. fraseri*.

- O. buckleyi* Higg., xii, 193.      *O. galactostoma* Anc., xii, 194.  
*O. fraseri* Pfr., xii, 193.      *O. augusti* Jouss., xii, 195.  
*v. brevispira* Pils., xii, 194.

#### Group of *O. deburghiae*.

- O. deburghiae* Rve., xii, 196.      *O. wrzesniowskii* Lub., xii, 198.  
*gloriosus* Pfr.      *O. maranhonensis* Alb., xii, 198.  
*v. elongata* Mill., xii, 198.

#### Group of *O. labeo*.

- O. labeo* Brod., xii, 199.      *O. yatesi* Pfr., xii, 202.  
*O. vicarius* Fult., xii, 200.      *v. sublabeo* 'Dohrn' Anc.  
*labeo* Rve.      *v. latevittata* Shutt.  
*O. shuttleworthi* Alb., xii, 201.      *O. kellesti* Rve, xii, 204.  
*v. fungairinoi* Hid., xii, 204.  
*yatesi* Hupé.

*Group of O. atramentarius.*

- O. powisianus* Pet., xii, 206.      *O. atramentarius* Pfr., xii, 209.  
*O. adamsoni* Gray, xii, 207.      *boussingaultii* Hupé.  
     *f. maculatus* Pils., xii, 208.      *iodes* Shuttl.  
*O. approximatus* Fult., xii, 209.

## Subfamily AMPHIBULIMINÆ.

Manual xii, p. 211. This group includes *Bulinulidæ* in which the shell is more or less degenerate, *Succinea*-shaped, *Haliotis*-shaped, or in the less modified forms, globose or ovate; always thin and mainly cuticular.

The group is a provisional one in its present limits, and probably composed of two independent lines of specialization: one from the *Drymæus*, *Zaplagius*, *Orychona* radical, leading to *Simpulopsis* and *Peltella*; the other perhaps diverging from a *Bulinulus*-like stem, including *Amphibulina* with its satellite groups, and *Gæotis*.

## Genus SIMPULOPSIS Beck, 1837.

Manual xii, p. 212.

The jaw is unknown, but probably like that of *Drymæus*. The radula of *S. sulculosa* has V-shaped rows of 70 teeth each, obliquely running forward, as in *Zaplagius* and the *Orthalicinæ*. The rhachidian tooth has a single conic cusp. The laterals have the mesocone much expanded, broad, ectocone small but well developed. The marginal teeth (fig. 12) resemble those of *Drymæus* and *Peltella*, having an oblique, trifid, broad cusp, the ectocone split (pl. 62, fig. 34, *S. sulculosa*, after Heynemann). The soft anatomy is otherwise unknown.

The species of the typical section are from Brazil, south of the Amazon, except *corrugata* from Trinidad and *vincentina* from St. Vincent.

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|--|---|
| <i>S. atrovirens</i> Moric., xii, 213.   | <i>S. rufovirens</i> Moric., xii, 216.  |
| <i>S. sulculosa</i> Fér., xii, 214.      | <i>rufescens</i> H. & A. Ad.            |
| <i>membranacea</i> Mich.                 | <i>S. corrugata</i> Gupp., xii, 217.    |
| <i>S. brasiliensis</i> Moric., xii, 215. | <i>S. miersi</i> Pfr., xii, 218.        |
| <i>obtusa</i> Pfr.                       | <i>S. tryoni</i> Pils., xii, 218.       |
| <i>S. obtusa</i> Sowb., xii, 216.        | <i>S. decussata</i> Pfr., xii, 218.     |
| <i>orata</i> Sowb.                       | <i>S. (?) vincentina</i> Sm., xii, 219. |

*Mexican Species.*

*S. simula* Morel., xii, 219.      *S. cumingi* Pfr., xii, 220.

## Section BULIMULOPSIS Pils., 1899.

Manual xii, p. 220. The soft anatomy of this group is unknown. Type *S. pseudosuccinea*. The species are Brazilian.

*S. pseudosuccinea* Moric., xii, 221.      *S. boissieri* Moric., xii, 222.

*moricandi* Pfr.      *S. progastor* Orb., xii, 223.

*S. citrinovitrea* Moric., xii, 221.

*B. vitrinoides* Rve.

## Subgenus PLATYSUCCINEA Ancy, 1881.

Manual xii, p. 223. *S. aenea* is Mexican, the other species Antillean.

*S. portoricensis* Shutt., xii, 224.      *S. dominicensis* Pfr., xii, 225.

*S. psidii* Mart., xii, 224.      *S. aenea* Pfr., xii, 225.

## Genus PELTELLA Webb and Van Beneden, 1836.

Manual, xii, p. 231. v. Ihering, Malak. Blätter (n. F.), viii, p. 57 (anatomy).

Slug-like, with the mantle large posterior, elevated, and perforate over a *Haliotis*-shaped fragile shell, consisting of between  $1\frac{1}{2}$  and 2 whorls. The jaw is highly-arched, closely plaited, very narrow in the middle (pl. 62, fig. 36). The radula is large, with 93.1.93 teeth in nearly straight transverse rows. The basal plates of the teeth are rhombic. Median tooth unicuspid, laterals with three cusps, as in *Drymaus* (pl. 61, fig. 26). The genital system (pl. 62, fig. 37) resembles that of *Bulinulus* except that the duct of the spermatheca is very short. The free retractor muscles are shortly united proximally. The columellar muscle is apparently degenerate. An excellent account of the anatomy has been given by Von Ihering, who first referred *Peltella* to the *Bulimulidæ*.

The genus is very distinct in many respects, and especially in the shortness of the duct of the spermatheca, the anal pouch, apparent absence of the columellar muscle, and of course the modifications consequent upon the reduction of the shell. The teeth of the radula seem to be almost identical in form with those of *Drymaus*.

*P. palliolum* Fér., xii, 231. Brazil, near Rio de Janeiro.

## Genus AMPHIBULIMA Lamarek, 1805.

Manual, xii, p. 232. Type *A. patula* Brug. *Amphibulia* RAFINESQUE, Binney & Tryon edit., p. 17.

Shell Succinea-shaped;  $1\frac{1}{2}$  apical whorls corrugated in the typical forms, smooth in s. g. *Pellicula*.

In *Amphibulima patula christopheri*, the kidney (pl. 62, fig. 27, K) is longer than the pericardium, its apex covered with venous reticulation. The ureter and secondary ureter (fig. 27, Ur.) are closed. The reticulation of the lung is anterior and on the gut or intestinal side, but extends further on the cardiac side than in *Bulimulinae*. The pulmonary vein seems to receive a large branch near its cardiac end. The reticulation spreads over the base of the pulmonary vein and the adjacent apex of the kidney. The greater part of the cardiac side of the lung is plain or weakly veined, as usual in the family.

The retractor muscles are essentially Bulimuline. The pharyngeal retractor spreads but is not split distally, at its insertion on the large buccal mass. At its base it is shortly united to the proximal end of the left ocular and pedal band. The right ocular band arises from the anterior surface of the broad columellar muscle, and retracts the eye through the branches of the genitalia. The connections of the muscles thus agree in all respects with *Bulimulus*, *Placostylus*, etc. (pl. 62, fig. 29).

The genital system (pl. 62, fig. 28) shows a short and very wide vagina and penis, the vas deferens inserted near, the retractor muscle at, the distal end. The duct of the spermatheca is very long and slender, abruptly swollen at its base and bound to the oviduct throughout. The albumen gland is small, the ovisperm duct being knotted adjacent to it. The ovo-testis is a large, compact mass of long, dichotomose cæca.

The jaw is horse-shoe-shaped, thin and flexible, composed of many (50-56) narrow plaits, the median ones not reaching the lower margin in the specimen examined by me (pl. 62, fig. 30, *A. patula* var. *christopheri*).

The radula of a St. Kitts specimen (*A. patula christopheri*, pl. 60, figs. 11, 12) is comparatively large, composed of about 160 teeth in a transverse row, the formula being 62.17.1.17.62, the 15th to 20th teeth on each side being transitional from laterals to the marginal type. The central row bears teeth with well expanded basal plates,

broad, rounded mesocones, and well developed ectocones. The laterals are similar, but asymmetrical by suppression of the entocone, as usual (pl. 60, fig. 11). The ectocone gradually increases, until on the transition teeth (left side of fig. 11) it is not greatly smaller than the mesocone. The inner marginals (last tooth to the left in fig. 11) have two subequal cusps. The outer marginal teeth (fig. 12) have three or four slender denticles, on a long, curved basal-plate, which on the outermost teeth is indistinguishable from the basement membrane except near the cusps.

Binney found substantially the same type of teeth in St. Kitts examples. Those from Dominica have a longer, pointed cusp on the central tooth, while Fischer found the cusps long and conic in the Guadalupe form, which with the same number of teeth in a transverse row has 20 laterals. The central teeth have no ectocones, according to Fischer. These divergencies indicate racial differentiation on the several islands, thus:—

*a.* Cusps of central and adjacent teeth pointed. *A. patula* and var. *dominicensis*.

*b.* Cusps of central and adjacent teeth broadly rounded or truncate; St. Kitts. Var. *christopherei* Pils.; pl. 60, f. 11, 12; pl. 62, f. 27–30.

*A. patula* is from Guadalupe and Marie-Galante, with varieties in Dominica, St. Kitts and Saba; *A. tigrina* is said to be from St. Vincent; *A. pardalina* and *A. browni* from Dominica, and *A. rawsoni* from Montserrat.

*A. patula* Brug., xii, 234.

*cucullata* Lam.

v. *dominicensis* Pils., xii, 237.

v. *christopherei* Pils., above.

*A. tigrina* Les. xii, 237.

*A. pardalina* Gupp., xii, 237.

*A. browni* Pils., xii, 238.

*A. rawsoni* Bld., xii, 239.

#### Subgenus RHODONYX Fischer, 1873.

Shell immaculate, rose-tinted, *Succinea*-shaped. Jaw (pl. 62, fig. 32) similar to that of *Amphibulima*, having 60–63 plaits. Radula (pl. 61, fig. 25, after Binney) with 47.13.1.13.47 teeth. The central tooth is tricuspid, middle cusp very large and broad, emarginate or truncate at the apex, side cusps pointed. The latter and inner marginal teeth are similar but without the entocone. The outer marginal teeth have long, narrow basal plates, like those of *Amphibulima*, and tridentate

cusps, the two outer denticles larger, as in *Gæotis*. Genital system similar to that of *Amphibulima*.

*A. rubescens* Dh. xii, 240. Martinique.

#### Subgenus PELLICULA Fischer, 1856.

Shell oval, *Succinea*-like, smooth, with extremely large aperture and small spire, composed of less than two whorls; columella with a thin, blade-like appendage. Animal externally almost slug-like, the mantle reflexed over the shell (pl. 62, fig. 33, *A. appendiculata*, after Fischer).

The jaw resembles that of *Amphibulima* but has fewer plaits, 40 in *appendiculata*, 23 in *depressa*. The radula of *appendiculata* has 32.12.1.12.32 teeth. These centrals are tricusps, the mesocone long and pointed; laterals with broader, shorter, but still conic cusps (pl. 62, fig. 31, after Binney). The genital system (pl. 62, fig. 35, *A. appendiculata*, after Fischer) is almost exactly like that of *Amphibulima patula*. Both species are from Guadalupe.

*A. appendiculata* Pfr., xii, 241. *A. depressa* Rang, xii, 242.

#### Genus GÆOTIS Shuttleworth, 1854.

Manual xii, p. 227.

The jaw is extremely thin and delicate, with over 40 narrow plaits, as in *Drymaeus* and *Urocoptis*, but with no triangular area in the middle (pl. 61, fig. 24, after Binney).

The radula is composed of V-shaped rows of teeth (pl. 61, fig. 24). "Centrals with base of attachment very long, narrow, obtuse above, incurved at the sides, obtusely rounded and expanded at base [posterior end], near which is a short, gouge-shaped expanded cusp, whose lower edge has three bluntly rounded cutting points. Laterals same as centrals in shape, but a little longer, and asymmetrical from the disproportionate expansion of the cutting-point. Marginals same as laterals, but more slender, with more developed and graceful cutting-points, of which the median is pointed, often bifid. There is much variety in shape and denticulation of the cusps. The middle denticle is always the smallest" (*Binney*).

The form of teeth shows a relationship to *Amphibulima*. All the species known are from Porto Rico.

*G. nigrolineata* Shuttl., xii, 229. *G. malleata* Pils., xii, 230.

*G. flavolineata* Shuttl., xii, 229. *G. albopunctulata* Shuttl., xii, 230.

## ERRATA.

*Draparnaudia gassiesi*. New name for *Bulinus turgidulus* Gassies (xiv, 16, 17), not *B. turgidulus* Desh. 1864.

*Draparnaudia sinistrorsa* Dh. xiv, 15. *Bul. sinistrorsus* Dh. is preoccupied by *B. sinistrorsus* Serres.

*Helicostyla fasciata* Pils. This name will replace that of *Bulinus effusus* Pfr., viii, p. 31, not *B. effusus* Bruguiere.

*Strophocheilus martensianus*. New name for *Bulinus grandis* Martens (x, 26), not *B. grandis* Deshayes.

*Bulinulus nanus* Rve., x, 141. The name is preoccupied by Lamarck.

*Bulinulus terebralis* Pfr. x, 142, not of Bruguiere, will become *Bulinulus ischnus* Pils.

*Bothriembryon inflatus* Lam. xiii, p. 3. Name preoccupied by *Bulinus inflatus* Olivier, Voy. Emp. Oth., I, 417. It has been called *B. ovum* by Gistel and others.

*Drymæus conus* Pils. New name for *B. coniformis* Pfr. xi, 276, not of Bruguiere.

Vol. XIV, p. 105, lines 3 and 4 from top, for "Bounanni" read Buonanni.





## INDEX TO BULIMULIDÆ, ETC.

NOTE.—Names of additional species originally described as *Bulimus*, will be found in the indices to *Achatinidæ* and *Buliminus*.

Names of genera and other groups are printed in SMALL CAPITALS; of synonyms in *Italic*. Numbers in black refer to the pages of the present part.

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<i>prostratus</i> Schaaf. xi, 225.		<i>pusillus</i> (Bulimulus) H. Ad. = ?	
<i>proteiformis</i> Dhrn. xi, 14.	28	<i>Opeas</i> .	
<i>proteii</i> Moric. xiv, 173.		<i>pustulosus</i> Brod. x, 153.	25
<i>proteus</i> Binn. xi, 143.		<i>pygmaeus</i> Brong. = <i>Hydrobia</i> .	
<i>proteus</i> Brod. xi, 13; xiv, 140.	28	<i>pyramidalis</i> Pfr. viii, 29.	
<i>proteus</i> Gldg. xi, 13; xii, 25.		<i>Pyrgus</i> Alb. x, 135.	
<i>PROTOGLYPTUS</i> Pils. xi, 84.	32	<i>pyriformis</i> Pils. xiv, 72.	
<i>prototypus</i> Pils. xii, 137; xiv, 164.	61	<i>pyrostomus</i> Pfr. xiii, 70.	
	42		
<i>protractus</i> Pfr. xi, 224.			
<i>provansali</i> Nicol. = <i>Nicolasia</i> .			
<i>proximus</i> Fult. ( <i>Amphi</i> .) xiii, 198.			
<i>proximus</i> Sowb. x, 22.			

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<i>quadricolor</i> Pfr. x, 83.	18
<i>quadrifasciatus</i> Aug. xi, 243.	43
<i>quadrifasciatus</i> Mart. xii, 43.	

*quadrifasciatus* Sch. xi, 259.  
*quadrasi* Hld. xiii, 229.  
*quagga* Hass. xiii, 234.  
*quinquefasciatus* Sch. xi, 259.  
*quitensis* Pfr. x, 158.  
*quyi* Cox. xiii, 8.  
*quoyi* Pfr. viii, 30.

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*rabuti* Jouss. xi, 239.  
*radiatus* Morel. x, 182; xiv, 137.  
*ragsdalei* Pils. xi, 129.  
*raimondianus* Pils. x, 167.  
*ramagei* E. A. Sm. xiv, 103.  
*rambiensis* Grt. xiii, 118.  
*ramentosus* Coop. xi, 153.  
*rawsoni* Gupp. xii, 20.  
*rawsonis* Bld. xii, 239.  
*rawsonis* H. Ad. xii, 20.  
*recedens* Pfr. xi, 221.  
*recluzianus* Pfr. xii, 55.  
*recognitus* Mab. xi, 137.  
*reconditus* Rve. x, 181; xiv, 137.  
*recta* Müll. xiii, 168.  
*rectilinearis* Pfr. xi, 232; xiv, 153.  
*rectistrigatus* Pils. xi, 176.  
*redditus* Rve. xi, 91.  
*reentsi* Ph. x, 155.  
*reentsii* Ph. (Helix), x, 129.  
*reevei* Desh. (Odont.) xiv, 48.  
*reevei* Pfr. vii, 206.  
*reevii* Brod. vii, 206.  
*reflexilabris* Schep. xiii, 206.  
*reflexus* Pfr. xi, 9.  
*regalis* Hupe xii, 180.  
*regina* Auct. xii, 181.  
*regina* Bowd. (Helix) xiv, 165.  
*regina* Fér. xii, 177.  
*regina* Hupe xii, 179.  
*reibischi* Dall xi, 122.  
*reinianus* (Bulimulus) Kob. = *Bulimulus*.  
*remotus* Hedl. xiii, 76.  
*requieni* Pfr. x, 55.  
*reses* Say xii, 109.  
*resuspinata* Schum. (Angystoma) xiv, 111.  
*reticulatus* Doer. xiv, 88.  
*retusus* Oliv. 1801 = *Clausilia*.  
*revinetus* Hupe xi, 17.  
*Rhabdotus* Alb. xi, 127.  
*Rhabdotus* Auct. x, 154.  
*Rhaphiellus* Pfr. xi, 94.  
*rhinocheti* Kob. xiii, 52.  
*Rhinus* Alb. xi, 74.  
*rhizophorarcus* Gass. xiii, 80.

*rhizophorarum* Gass. xiii, 80.  
*rhizophoratus* Gass. xiii, 80.  
*rhodacme* Pfr. x, 152.  
*rhodinostoma* Orb. xiv, 51.  
*rhodocheilus* Rve. x, 8.  
*rhodolarynx* Rve. xi, 171.  
*RHODONYX* Fisch. xii, 239.  
*rhodospirus* P. & M. x, 103.  
*rhodostoma* Gray xiii, 14.  
*rhodostylus* Mlldff. xiv, 168.  
*rhodotrema* Mart. xii, 69.  
*ribeiroi* Tourn. 1879, Mioc.  
*ridleyi* Sm. xi, 82; xiv, 103.  
*riisei* Pfr. xi, 41.  
*rillyensis* Boiss (Pupa) = *Rillyia*.  
*rimatus* Pfr. xi, 157.  
*ringens* auct. (Anost.) xiv, 111.  
*ringens* Dkr. xiv, 49.  
*ringens* Jay. xiv, 64.  
*ringens* L. (Anost.) xiv, 114.  
*ringens* Sowb. (Helicodon) xiv, 113.  
*RINGICELLA* Gray xiv, 114.  
*ringicula* Fér. (Helix) xiv, 115.  
*riochanus* Doer. xiv, 84.  
*riojanus* Doer. xiv, 83.  
*rivasii* Orb. xi, 91.  
*robustus* Fult. xiii, 139.  
*rocæ* Doer. xiv, 97.  
*rocayanus* Orb. xi, 321.  
*roemeri* Pfr. xiii, 192.  
*roeseleri* Mlldff. xiii, 144.  
*romblonensis* Pfr. viii, 16.  
*rosacens* King x, 33.  
*rosea* Fult. xiii, 233.  
*rosea* Spix. (Ampullaria) x, 30.  
*roseatus* Rve. xi, 301; xiv, 161.  
*roseolabius* Fult. xiii, 188.  
*roseolabrum* Sm. x, 73.  
*roseotineta* Mlldff. xiii, 170, 237.  
*roseotinetus* Mlldff. xiv, 169.  
*rosens* Ads. xiii, 106.  
*rossiteri* Braz. xiii, 34.  
*rossiteri* Hartm. xiii, 73.  
*ronaulti* Hupé x, 176.  
*rubellus* Brod. xi, 275.  
*rubescens* Dh. xii, 240.  
*rubescens* Rve. x, 157.  
*rubidus* Zgl. Villa. p. 21.  
*rubiginosus* Fult. xiii, 224.  
*rubra* Pfr. xii, 25.  
*rubrifasciatus* Rve. xi, 38.  
*rubrovariegatus* Higg. xi, 270.  
*rundis* Aut. xii, 49.  
*rufescens* Ads. xii, 217.  
*rufescens* Gray xii, 9.  
*rufocinctus* Fult. xiii, 223.  
*rufogaster* Pfr. vii, 207.

rufolineatus Dr. xi, 308.  
 rufopictus Bs. xiv, 5.  
 rufovirens Moric. xii, 216.  
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- saccatus* Pfr. xi, 228.  
*sachsei* Alb. xi, 273.  
*salernensis* Math. 1870.  
*salleanus* Rve. = *Stenogyra*.  
*sallei* Pils. xii, 11.  
*salinicola* Doer. xiv, 99.  
*salinicola* Doer. xiv, 87.  
*salomonis* Pfr. (Simp.) xii, 226.  
*salomonis* Alb. (Simp.) xii, 226.  
*salomonis* Pfr. xiii, 69.  
*salteri* Sowb. x, 52.  
*sanchristovalensis* Cox xiii, 97.  
*sanctelucæ* Sm. xi, 86.  
*santacruzensis* Pfr. x, 17.  
*santacrucis* Bk. x, 17.  
*sanctemarthæ* Pils. xiv, 161.  
*santacruzii* Orb. x, 16.  
*santanensis* Pfr. = *Opeas*.  
*sanctipauli* Iher. & Pils. xiv, 123.  
*sandysii* Prime, 1859.  
*sangoræ* Tschud. x, 45.  
*sarcinosus* Pfr. vii, 196.  
*sarcochilus* Pfr. xi, 80.  
*sarcochrous* Pils. xi, 93.  
*sarcodes* Pfr. xi, 56.  
*sargi* C. & F. xii, 65.  
*saturanus* Pfr. xii, 144.  
*saturnus* Pfr. xii, 153.  
*savesi* Cr. xiii, 33.  
*saxtoni* Lay. xiii, 65.  
*sayi* Pfr. xiii, 8.  
*scaber* Brug. = *Melania*.  
*scabiosus* Sowb. x, 142.  
*scabrellus* Anth. xiv, 62.  
*scalaticosta* Morel. x, 132.  
*scalariformis* Brod. x, 169.  
*scalarinus* Gundl. = *Melaniella*.  
*SCALARINELLA* Doer. xiv, 66.  
*scalaroides* Ph. x, 154.  
*scarabæus* Brug. = *Pythia*.  
*scarabus* Alb. xiii, 65.  
*schiedeanus* Auct. xi, 130.  
*schiedeanus* Pfr. xi, 131.  
*schmidtii* Pfr. xi, 195.  
*schomburgki* Pfr. xiii, 182.  
*scitulus* Rve. xi, 271.  
*scitus* H. Ad. xi, 224.  
*scobinatus* Wood xi, 77.  
*scoliodes* Dantz.  
*scottii* Cox. xiii, 90.  
*sculpturatus* Pfr. xi, 120.  
*SCUTALUS* Alb. xi, 12.  
*scutillus* Migh. 1845.  
*seutulatus* Brod. x, 165.  
*seytodes* Pfr. x, 84.  
*sealiannus* Fbs.  
*sectilabris* Pfr. xiv, 61.  
*seemanni* Dhn. xiii, 160.  
*sellersi* Cox xiii, 95.  
*semicinctus* Pils. xi, 44.  
*Semichlausaria* Pfr. xi, 191.  
*semifasciatus* Mss. xi, 298.  
*semifrenatus* Mart. xiii, 219.  
*semilineata* Mke. (Helix) x, 30.  
*semimaculatus* Pils. x, 297; xii, 71;  
 xiv, 159.  
*seminiger* Mke. = *Achatinella*.  
*semipellucidus* Tris. xii, 82.  
*semipictus* Hid. x, 87.  
*semistriatus* Morel. = *Stenogyra*.  
*semitessellatus* Morl. xiii, 194.  
*semperi* Dhn. x, 94.  
*seneri* Jous. x, 31.  
*senilis* Gass. xiii, 53.  
*septemplicata* Mühlf. xiv, 58.  
*septenarius* Brug. = *Subulina*.  
*sepulchralis* Poey. xi, 49.  
*serenus* Ph. xi, 285.  
*seringi* Mich. J. de C., 1862.  
*serotinus* Morel. xi, 293.  
*serperastrum* Say xii, 37.  
*serperastrus* Say xii, 38.  
*serriatus* Pfr. xi, 218.  
*serresi* Math. = *Rillyia*.  
*servaini* Enth. xiii, 30.  
*sexdentatus* Auct. xiv, 60.  
*sexdentatus* Spix xiv, 59.  
*sexfasciatus* Schaaf. xi, 259.  
*sextonus* Lam. 1804 = *Bythinia*.  
*shongii* Less. xiii, 22.  
*shuttleworthi* Alb. xii, 201.  
*siamensis* Redf. = *Ganesella*.  
*siculus* Brug. = *Limnæa*.  
*signata* Spix x, 107.  
*signifer* Pfr. xi, 210.  
*sileni* Beck (Pelek.) x, 66.  
*sileni* Lam. x, 114.

- similaris* Moric. xi, 233.  
*similis* Brug. = *Papa*.  
*simoni* Jouss. xiv, 7.  
*simplex* Bk. xi, 38.  
*simplex* Cr. xiii, 56.  
*simplex* Fult. (Amphi.) xiii, 222.  
*simplex* Hupe xi, 72.  
*simplex* Jonas viii, 34.  
*simpliculus* Pfr. x, 176; xiv, 137.  
*SIMPULOPSIS* Bk. xii, 212.  
*simrothi* Reib. xi, 117.  
*simula* Morel. xii, 219.  
*Simulopsis* Gray xii, 212.  
*sinensis* Bs. xiii, 190.  
*singularis* Morel. (Plac.) xiii, 58.  
*singularis* Pfr. (Drap.), xiv, 14.  
*sinistrorsa* Dh. xiv, 15, 283.  
*sinistralis* Rve. xiii, 232.  
*sinistra* Müll. xiii, 147.  
*sinistrorsa* Cr. xiii, 40.  
*sinistrorsus* Dh. xiv, 15, 283.  
*sinistrorsus* (Bulimus) Serres, 1838  
 = *Clausilia*.  
*sinistrorsus* Tate = *Pupoides*.  
*sinuata* Alb. x, 116.  
*sisalensis* Morel. xii, 28.  
*smaragdinus* Rve. viii, 38.  
*smithii* DaC. xi, 247.  
*smithii* Fult. (Amphi.) xiii, 186.  
*smithi* Kob. (Plac.) xiii, 66.  
*snodgrassi* Dall. xiv, 150.  
*solida* Say xii, 168.  
*solidulus* Brug. = *Aetæon*.  
*solidus* Eth. (Plac.), xiii, 27.  
*solidus* Fult. (Amphi.) xiii, 229.  
*solidus* Pfr. viii, 8.  
*solidus* Pils. xiii, 9.  
*solivagus* Rve. viii, 9.  
*solutus* Trosch. x, 133.  
*SONORINA* Pils. xi, 155.  
*sordidus* Dh. xi, 13.  
*sordidus* King x, 55.  
*sordidus* Less. x, 163.  
*souverbianus* Gass. = *Opas*.  
*souvillei* Morel. xiii, 48.  
*sowerbeyi* Swains. xiv, 31.  
*sowerbyi* Pfr. xi, 174.  
*sowerbiana* Fér. (Helix), xiv, 95.  
*sowerbyana* Bk. xiv, 95.  
*speciosus* Pfr. x, 70.  
*spectatus* Rve. xi, 213.  
*spectrum* Alb. x, 119.  
*spectrum* Bk. = *Obeliscus*.  
*spenceri* Tate xiii, 6.  
*spiculatus* Morel. x, 144.  
*spirifer* Gabb. xi, 158.  
*SPIXIA* Pils. & Van. xiv, 67.
- 42 *spixii* Bk. (Anost.) xiv, 106.  
*spixii* P. & M. x, 175.  
*spixii* Rve. x, 59.  
 54 *spixii* Wagn. (1827) x, 55.  
*spixi* Orb. (Odont.) xiv, 67.  
 31 *spixi* Pfr. x, 55.  
*splendidus* Dh. = *Rillyia*.  
*sporlederi* Pfr. xii, 66.  
 26 *sporadiens* Orb. xi, 67.  
 66 *sporadicus* Rve. xi, 273.  
 34 *spretus* Phil. x, 167.  
 67 *spretus* Rve. viii, 16.  
*squamulatus* C. & J. x, 34.  
*stagnalis* Brug. = *Limnea*.  
 54 *stearnsianus* Pils. xiv, 92.  
*stearnsii* Dall. xiv, 103.  
*steerei* Pils. xiv, 140.  
*stelzneri* Dh. x, 180.  
*stelzneri* Doer. xiv, 67.  
 53 *stenacme* Pfr. x, 182; xiv, 137.  
 71 *stenacme* x, 182.  
*stenogyroides* Gupp. xi, 49.  
*Stenostoma* Spix. x, 96; xiv, 36.  
*STENOSTYLUS* Pils. xi, 313.  
 16 *stigmaticus* Ph. xi, 281.  
*stilbe* Pils. xiv, 145.  
 43 *stolli* Mart. xii, 50.  
 54 *stramineus* Anet. xii, 12.  
 33 *stramineus* Braz. xiii, 95.  
*stramineus* Gldg. xii, 13.  
*strangei* Pfr. xiii, 87.  
*strebeli* Pils. xii, 128.  
*striata* Perry (Melania) xiv, 167.  
 53 *striata* Spix. (Pupa) xiv, 68.  
*striatellus* Bk. x, 179.  
*striatellus* C. B. Ad. = *Nothus*  
 51 *conferta*.  
*striatocostatus* Orb. = *Melaniella*.  
 24 *striatulus* Brug. = *Bucc. striatulum*  
 36 *Müll.*  
 25 *striatulus* Dall. xi, 143.  
*striatulus* Lam. 1804 = ?*Hydro-*  
*biidae*.  
 54 *striatulus* Sowb. x, 162.  
*striatus* Brug. = *Achatiinidae*.  
*striatus* King x, 179.  
 36 *strictus* Poey = *Stenogyra*.  
*strigata* Mildff. xiii, 132.  
 17 *strigatus* Pils. xiii, 46.  
 41 *strigatus* Rve. xi, 231.  
 16 *strigatus* Sowb. xi, 228; xiv, 158.  
*strigosus* Mart. xiii, 152.  
*strobili* Doer. xiv, 99.  
 51 *struthiolaris* Mke. x, 103.  
 24 *stubeli* Mart. x, 42.  
 36 *studer* Pfr. xi, 246.  
 57 *stutchburyi* Pfr. xiii, 88.

- stylicher Bk. x, 156.  
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*subantiquatus* Bk. xii, 2.  
*subcactorum* Pils. x, 145.  
*subcarinatus* Pfr. viii, 19.  
*subconcolor* Mart. xiii, 212.  
*subconoidalis* Anc. xi, 109.  
*subcylindricus* Math. 1842 = Rillyia.  
*subeffusus* Kob. (Plac.) xiii, 39. 53  
*subeffusus* Ph. xi, 217. 41  
*subfasciatus* Ckll. xii, 3.  
*subfasciatus* Pfr. xi, 32. 28  
*subfloccosus* Pils. xii, 90. 48  
*subglandiformis* Mss. x, 80; xiv. 17  
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*subglobosus* Lea vii, 204.  
*subinterruptus* Pfr. xi, 244. 43  
*subirroratus* DaC. xiv, 163. 62  
*subjusseni* Pils. xi, 26. 28  
*sublabeo* Anc. xii, 203. 65  
*sublaevis* Pils. x, 111. 16  
*submariei* Sowb. xiii, 55. 54  
*subpellucidus* Sm. xi, 288. 44  
*sulphureus* Pfr. xii, 76; xiv, 162. 48  
*subplicata* Pfr. x, 199; xiv, 180. 18  
*subprotractus* Pils. xiv, 155. 42  
*subpulchella* Pils. xii, 141. 61  
*subroseus* Ph. xi, 284. 44  
*subsemiclausus* Pet. xi, 238. 42  
*subsenilis* Gass. xiii, 53. 54  
*subsexdentatus* Doer. xiv, 85.  
*subsimilaris* Pils. xi, 222. 41  
*subsordida* Pils. (Helix) x, 163. 36  
*subspirifer* Mab. xi, 162.  
*subsuctatus* Mss. xiv, 173. 31  
*subtenuis* Pils. xi, 76. 49  
*subtropicalis* Doer. xi, 67.  
*subtuszonata* Pils. xii, 95.  
*subula* C. B. Ad. = Euspiraxis pro-  
 cera.  
*subula* Pfr. = Opeas.  
*subulatus* Cr. xiii, 63. 54  
*subunicolor* Fult. (Amphi.) xiii, 222. 47  
*subunicolor* Mart. xii, 59. 41  
*subventricosus* DaC. xiv, 156.  
*succinetus* Rve. viii, 17. 45  
*succinea* Pils. xiv, 160.  
*succinoides* Mart. x, 84.  
*succineus* Brug. = Succinea.  
*succinoides* Pet. x, 84; xiv, 128. 18  
*sufflatus* Gld. xi, 136. 35  
*suffusus* Rve. = Limicolaria.  
*sulcatus* Reib. xi, 101.  
*sulcosus* Pfr. xii, 48. 47  
*sulculosa* Fér. xii, 214. 66  
*sulfuratus* Mart. xiii, 143. 25  
*sulfureus* Mart. xii, 77. 48  
*sulphuratus* H. & J. xiii, 143. 65  
*sultana* Dillw. xii, 188.  
*Sultana* Shutt. xii, 186.  
*sultanus* Lam. xiii, 154.  
*sumatranus* Mts. xiii, 218, 228.  
*sumbaensis* Fult. xiii, 208.  
*superbus* Fult. (Amphi.) xiii, 223.  
*superbus* Jonas x, 43.  
*superfasciatus* Gass. xiii, 40. 53  
*superstriatus* Sowb. x, 91. 19  
*surgillatus* Pfr. xiv, 53.  
*suspectus* Mart. xiii, 213.  
*swainsoni* Pfr. x, 105. 15  
*swiftianus* Pfr. = Stenogyra.  
*swinhoeana* Pils. xiv, 19.  
*swinhoei* Pfr. xiv, 19.  
*sylheticus* Rve. xiii, 189.  
*sylvanus* Brod. viii, 48.  
*sylvaticus* Wagn. = Neobeliscus.  
*SYNDROMUS* Pils. xiii, 184.  
*sytodes* Ads. x, 199.

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- teniatus* Ph. xi, 291.  
*taeniolus* Nyst. x, 57. 21  
*tanneri* Dall. xi, 113; xiv, 152. 34  
*tanouensis* Cr. xiii, 66. 54  
*tapadoides* Ph. xi, 317. 49  
*taquinensis* Pfr. x, 81. 17  
*tarmensis* Ph. x, 60. 21  
*tasmanicus* Pfr. xiii, 18. 51  
*tateanus* Gupp. xi, 80.  
*Tatutor* Jouss. x, 43.  
*tatutor* Jouss. x, 47. 21  
*taunaisii* Fér. x, 48. 21  
*taunaysii* Orb. x, 49.  
*taylorianus* Rve. x, 90; xiv, 132. 19  
*taylorioides* Mill. x, 90.  
*techioensis* Kob. xiii, 38. 53  
*TEMESA* Ads. x, 134.  
*tenellus* Bk. Ind. p. 63.  
*tenellum* Dall, Paet. xiii, 234.  
*tener* Mts. xiii, 136.  
*tenuicostatus* Matheron.  
*tenuilabris* Pfr. xi, 310. 45  
*tenuiplicatus* Pfr. = Macroceramus.  
*tenuis* Ant. xiv, 172.  
*tenuis* Dkr. xi, 65.  
*tenuissimus* Orb. xi, 64, 320. 30  
*tenuissimus* Sm. xi, 49.  
*tenuistriatus* Sowb. 1846 = Rillyia.  
*tepecensis* Mart. xii, 84. 48  
*terebella* C. B. Ad. = Opeas.  
*terebellatus* Lam. = Niso.  
*terebellum* Brug. = Pyramidella.



terebialis Brug. = Melania.		trivittatus Mss. xi, 245.	43
terebialis Pfr. x, 142.	24, 71	trizonalis Fér. xiv, 4.	
terebra Matheron, 1832.		tropicalis Morel. xii, 85.	48
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